1981 - 1982 Mercury Levels in Fish of the Assiniboine, Red, Souris and Winnipeg Rivers

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1981 - 1982 MERCURY LEVELS IN FISH OF THE ASSINIBOINE, RED, SOURIS AND WINNIPEG RIVERS

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ABSTRACT

As a component of the Biomonitoring Program, mercury concentrations in the muscle tissue of fish have been monitored since 1978. During 1981 and 1982, mean mercury concentrations greater than 0.50 µg/g were found in the muscle tissue of many species important to localized sport fisheries on the Assiniboine, Red, Souris and Winnipeg Rivers. Data were, in many instances, adequate for the development of significant regressions from which fish weights corresponding to specific mercury concentrations could be estimated.

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SUMMARY

The Biomonitoring Program commenced in 1978. As in previous years, the mercury facet of the 1981 and 1982 program warrants special attention.

Muscle tissue samples were collected from the dominant large-sized fish species occurring at several locations on the Assiniboine, Red, Souris and Winnipeg Rivers. The samples were analyzed for mercury content and the results were statistically compared to those of previous years. Where data permitted, mercury concentrations versus fish weight regressions were developed and used to estimate weights at which various species might be expected to contain excessive muscle tissue mercury concentrations.

Walleye from the Assiniboine River biomonitoring sites generally possessed mean mercury concentrations in excess of the 0.50 µg/g level. Additionally, it was estimated that walleye larger than the 575g - 880g range might be expected to exceed the 0.50 µg/g level and, if larger than approximately 2000g, might be expected to possess muscle tissue mercury concentrations greater than the 1.0 µg/g level. Walleye from Emerson and St. Norbert exhibited patterns similar to Assiniboine River fish. Although mean mercury concentrations in walleye collected near Selkirk were lower than the 0.50 µg/g level, it was estimated that fish larger than approximately 1750g might be expected to exceed the 0.50 µg/g level. In general, Winnipeg River walleye also possessed excessive mean mercury concentrations which were highest at Eaglenest Lake and lowest at Lac du Bonnet. Most walleye from the Souris River were also found to contain excessive mercury concentrations.

Northern pike from Portage la Prairie and the three Winnipeg River biomonitoring sites generally possessed mean mercury concentrations in excess of the 0.50 µg/g level. Particularly contaminated were Eaglenest Lake fish which were estimated to possess mercury concentrations in excess of the 1.5 µg/g level at weights greater then approximately 2750g.

Sauger from Portage la Prairie, Emerson and St. Norbert frequently possessed mercury concentrations above 0.50 µg/g. Additionally, it was estimated that sauger from the Red River at Selkirk which were larger than approximately 330g might also be expected to exceed the 0.50 µg/g level. Although Lac du Bonnet sauger still contain mean concentrations in excess of 0.50 µg/g, the data suggests that mercury concentrations have been progressively declining since inception of the Biomonitoring Program.

Large channel catfish (i.e. >4000g) and goldeye (i.e. >480g) from Emerson and St. Norbert might be expected to possess excessive mercury concentrations. Hooneye, goldeye, freshwater drum, lake whitefish and most suckers generally possessed mean mercury concentrations well below the 0.50 µg/g level.

The mean 1981 and 1982 mercury concentrations showed few statistically significant changes from those of previous years.

INTRODUCTION

The Environmental Management Division instituted a comprehensive system of monitoring surface water quality by commencing a Biomonitoring Program in 1978. This program is being carried out in the Assiniboine, Red, Souris and Winnipeg Rivers. It consists of measuring trace metal and biocide levels in fish muscle tissue and collecting information respecting benthic and planktonic communities. These data are integrated with water column physicochemical data to provide a more accurate and meaningful assessment of surface water quality. As in previous years, mercury levels in fish muscle tissue warrant special attention. This report focuses on the results of the mercury facet of the 1981 and 1982 portion of the Biomonitoring Program.

The basic objective and design of the program were not developed to exhaustively determine the extent of mercury contamination in the fish of Manitoba's waterways. Hence, data are limited and do not, in all instances, pertain to all important fish species inhabiting biomonitored sites. However, the degree of analytical precision and accuracy and the similarity to previous data tends to validate the results presented.

METHODS AND IMPLEMENTATION

Fish specimens were collected by gillnets set at nine (1981) and ten (1982) sites on the Assiniboine, Red, Souris and Winnipeg River (Figure 1) during September and October of each year. Boneless and skinless fillets from a representative sample of the species captured at each site were collected along with general physical data and evidence of age.

Fillet samples were submitted to the W. H. Ward Technical Services Laboratory for analysis of mercury content. A hot digestion process (Hendzel and Jamieson, 1976) was utilized for sample preparation. Evidences of age (eg. otoliths, scales, fin rays, etc.; species dependent) were submitted to the Biological Services Branch of the Manitoba Department of Natural Resources for analysis in a manner adapted from Lagler (1964) and Cuerrier(1951).

Regressions of concentration on weight were developed from the 1981 and 1982 data. Mercury values were estimated from the regressions for four equidistant weights of a range common to both current and previous years data. This was done in order to compensate for differences in observed values skewed by sampling significantly different sizes of fish. Analyses of variance were then conducted on both observed and estimated value series in order to provide a statistical comparison between the 1978 through 1982 mercury levels. Where differences in annual means were not significant or, alternately, could be ascribed to annual differences in mean weights of fish sampled, further regressions were developed from combined

(1978-1982) data. These latter were tested for significance (t_{α} = 0.05) and utilized to provide a wider range of estimated weight dependent mercury concentrations.

Comments pertaining to sport fishing pursuits are derived from informal interviews and observations of anglers at each of the biomonitoring sites.

RESULTS AND DISCUSSION

A total of 457 fish were sampled during the 1981 Biomonitoring Program and 505 during that of 1982. Summaries of the mercury data are presented in Tables 1 and 2, respectively. General meristic data and corresponding mercury analytical results are detailed in Appendices 1(a-i) and 2(a-j). Regressions of 1981 and 1982 mercury concentrations on fish weight and respective estimated mercury concentrations are presented in Appendix 3. The results of analysis of variance performed on both observed and estimated mercury concentrations are detailed in Table 3. Table 4, which could be used for general reference purposes by anglers, presents regressions and a range of estimated mercury concentrations at various weights (when valid). These were derived from data accumulated to the present.

A. THE ASSINIBOINE RIVER

Biomonitoring of the Assiniboine River at Lake of the Prairies was initiated in 1982. The Brandon and Portage la Prairie sites (Figure 1) have been biomonitored since 1978.

A.1 LAKE OF THE PRAIRIES

Lake of the Prairies was formed by the construction in 1968 of the Shellmouth Dam across the Assiniboine River. Rigorous stocking efforts by the Fisheries Branch have resulted in a large population of walleye within the reservoir. These walleye, along with northern pike, form the basis of a substantial sport fishery. Yellow perch and

rock bass apparently are also taken on a regular basis. Additionally, common suckers and shorthead redhorse suckers support a popular spring dip netting fishery.

A total of twenty walleye were sampled during the 1982 Biomonitoring Program. Individual mercury concentrations varied from 0.22 µg/g to 1.20 µg/g, with a mean of 0.62 µg/g (Table 2). The size of fish sampled ranged from 300g to 2460g. Thirteen (65%) of the walleye sampled exceeded the 0.50 µg/g level; two (10%) of which exceeded the 1.0 µg/g level. None of the walleye exceeded the 1.5 µg/g level. The regression [µgHg/g= 3.91×10^{-4}(g weight of fish) + 0.26] showed a significant association (r^2 = 0.65) between mercury concentrations and fish weight (Table 4). Thus, the weights at which walleye could be expected to exceed the 0.5 µg/g and 1.0 µg/g levels were estimated at approximately 625g and 1875g, respectively (Table 4). However, it must be emphasized that the sample size (N = 20) was relatively small and representative only of 1982 concentrations. Hence, future data may necessitate some adjustments to both projected values and the observed walleye mean.

Ten common suckers were sampled during the 1982 program. Mercury concentrations varied from 0.13 to 0.23 µg/g, with a mean of 0.19 µg/g (Table 2.) The size of fish sampled ranged from 1040g to 1580g. None of the common suckers sampled exceeded the 0.50 µg/g level. Probably due to the narrow size range sampled, the regression did not show a significant association (r^2 = 0.12) between mercury

concentrations and fish weight (Table 4). Thus, estimated mercury concentrations were not projected for specific weights.

Nine shorthead redhorse suckers were collected and sampled at Lake of the Prairies during the 1982 program. None exceeded the 0.50 µg/g level. The observed mercury concentrations varied from 0.03 µg/g to 0.13 µg/g, with a mean of 0.09 µg/g (Table 2). The size of fish sampled ranged from 600g to 1940g. Unlike common suckers, the larger size range produced a significant association (r^2 = 0.73) between mercury concentrations and fish weight for the regression [µgHg/g = 6.88 x 10^{-5}(g weight of fish) + 0.003]. Estimated mercury concentrations did not exceed the 0.50 µg/g level for the realistic size range of shorthead redhorse suckers encountered in Lake of the Prairies (Table 4).

Although pike and, to a lesser extent perch, are frequently taken by anglers, only one of each species was collected by biomonitoring gillnets. Neither fish was particularly large (1390g, and 180g, respectively) and neither exceeded the 0.50 µg/g level (0.28 µg/g, and 0.07 µg/g) respectively (Table 2). A definitive statement concerning mercury concentrations in pike and perch cannot be made on the basis of single samples and must await a larger data base.

A.2 BRANDON

Two of the more popular sites with anglers on the Assiniboine River at Brandon are located at the Manitoba Hydro weir and the Third Street Dam. Species most actively pursued include

walleye, mooneye and pike. Both common suckers and shorthead redhorse suckers are frequently landed but apparently are not utilized to any great extent. Landings of perch, sauger, rock bass and channel catfish are not uncommon.

Ten common suckers were sampled during both the 1981 and 1982 Biomonitoring Programs. The sizes of fish sampled ranged from 480g to 1110g during 1981 and from 400g to 720g during 1982. The 1981 mercury concentrations varied from 0.11 µg/g to 0.53 µg/g, with a mean of 0.30 µg/g (Table 1). The 1982 mercury concentrations varied from 0.04 µg/g to 0.32 µg/g, with a mean of 0.19 µg/g (Table 2). Analysis of variance (Table 3) revealed that annual mean mercury concentrations did not differ significantly during the period 1978 to 1982, inclusive. A significant (r^2 = 0.20) regression [µgHg/g= 2.93 x 10^{-4}(g weight of fish) + 0.01] was developed from combined (1978-1982) data and indicated that common suckers of the size range encountered during the entire biomonitoring period were not expected to normally exceed the 0.50 µg/g level (Table 4). The estimation was confirmed by the data as only three (6%) of the common suckers sampled since 1978 had mercury concentrations in excess of 0.50 µg/g.

Mooneye, like common suckers, were also sampled at the rate of ten fish per year. The sizes sampled ranged from 330g to 490g during 1981 and from 200g to 400g during 1982. The 1981 mercury concentrations varied from 0.16 µg/g to 0.53 µg/g, with a mean of 0.38 µg/g (Table 1). Two (20%) of these fish exceeded the 0.50 µg/g level. The 1982 mercury concentrtations varied from 0.07 µg/g to 0.35 µg/g, with a mean of 0.18 µg/g (Table 2).

None exceeded the 0.50 µg/g level. Though observed annual mean mercury concentrations for the period 1978 to 1982 (inclusive) differed significantly, analysis of variance performed on regression estimated values were not significantly different (Table 3). Thus, differences in observed annual mean concentrations were at least partially attributable to significant differences in the sizes of fish sampled each year. The regression developed from combined (1978 to 1982) data was poorly correlated (r^2 = 0.17) and indicated a non significant association between mercury concentrations and fish weight (Table 4). Thus, concentrations could not be estimated for specific sizes of fish encountered. However, the five year (1978 to 1982) mean of 0.31 $\pm$ 0.01 µg/g suggests that mooneye at Brandon, on average, do not exceed the 0.50 µg/g level. Indeed, the entire biomonitoring period data records a total of only three (6%) mooneye exceeding the 0.50 µg/g level at Brandon.

Ten walleye were sampled during 1981 and ranged in size from 360g to 2520g. Mercury concentrations varied from 0.30 µg/g to 1.45 µg/g, with a mean of 0.66 µg/g (Table 1). Eight (80%) of the 1981 walleye exceeded the 0.50 µg/g level, one (10%) of which exceeded the 1.0 µg/g level. The eleven walleye sampled during 1982 ranged in size from 220g to 2320g. Mercury concentrations varied from 0.16 µg/g to 1.60 µg/g with a mean of 0.59 µg/g (Table 2). Five (45%) exceeded the 0.50 µg/g level, two (18%) of which exceeded the 1.0 µg/g level. Analysis of variance (Table 3) indicated that significant differences did not occur between the annual means of the entire

(1978 to 1982) biomonitoring period. The regression [μgHg/g = 3.80×10^{-4}(g weight of fish) + 0.28] developed from combined (1978 to 1982) data showed a significant association (r^2 = 0.47) between fish weight and muscle tissue mercury concentrations (Table 4). Thus, the sizes at which Brandon walleye could be expected to exceed the 0.50 μg/g and 1.0 μg/g levels were estimated at approximately 575g and 1825g, respectively (Table 4).

Northern pike are not biomonitored on a regular basis and are sampled only when incidentally netted. Thus, no fish were sampled in 1981. Three pike, ranging in size from 1200g to 1560g, were sampled in 1982. Mercury concentrations varied from 0.21 μg/g to 0.83 μg/g, with a mean of 0.42 μg/g (Table 2). A significant difference between the 1980 and 1982 means was not observed (Table 3). Combined data (1980 and 1982) failed to yeild a significant regression (r^2 = 0.18) of mercury concentrations versus fish weight. However, combined data did suggest that, on average, 20% of the northern pike from Brandon possess mercury concentrations in excess of 0.50 μg/g.

One channel catfish was sampled in 1981. This specimen weighed 2430g and had a muscle tissue mercury concentration of 0.24 μg/g. Six catfish, ranging in size from 340g to 2310g, were sampled in 1982. Mercury concentrations varied from 0.04 μg/g to 0.29 μg/g (Table 2). Combined data (1981-1982) yielded a significant (r^2 = 0.78) regression [μgHg/g = 1.07×10^{-4}(g weight of fish) + 0.04] from which estimated mercury concentrations did not exceed the 0.50 μg/g level for the size range of fish encountered (Table 4).

Shorthead redhorse suckers, though relatively abundant, were first sampled in 1982. The size of fish sampled ranged from 340g to 820g. Mercury concentrations varied from 0.08 µg/g to 0.54 µg/g, with a mean of 0.20 µg/g (Table 2). Only one (10%) of the fish sampled exceeded the 0.50 µg/g level. A significant (r^2 = 0.45) regression [µgHg/g = 5.26 x 10^{-4}(g weight of fish) - 0.11] was developed from the data and suggested that mercury concentrations generally do not exceed the 0.50 µg/g level in the size range encountered during the 1982 Biomonitoring Program.

Three rock bass were collected and sampled during 1982. These ranged in size from 180g to 260g and exhibited a mean mercury concentration of 0.21 µg/g (Table 2). The small sample and narrow size range did not permit development of a significant (r^2 = 0.01) regression (Table 4).

A.3 PORTAGE LA PRAIRIE

A substantial sport fishery has developed immediately downstream of the Assiniboine River diversion dam at Portage la Prairie. The primary target species of anglers at this site include sauger, pike and walleye. Also landed and retained to a lesser degree are goldeye, freshwater drum, channel catfish, carp and shorthead redhorse suckers.

Only five sauger ranging in size from 170g to 780g, were sampled during 1981. Mercury concentrations varied from 0.33 µg/g to 1.81 µg/g, with a mean of 0.90 µg/g (Table 1). The 1982 sample consisted of ten sauger generally smaller in size than that normally

collected. These specimens ranged from 70g to 340g. Mercury concentrations varied from 0.24 µg/g to 0.38 µg/g, with a mean of 0.29 µg/g (Table 2). Considering the obvious differences between 1981 and 1982 data, it was not surprising that analysis of variance performed on all collected (1978 to 1982) data indicated that significant differences existed between the annual means (Table 3). Analysis of variance performed on regression estimated values from the same period (Table 3) further suggested that the significant differences observed were not attributable solely to annual differences in the sizes of fish sampled. However, because the annual regressions were based on narrow size ranges and did not indicate significant associations between size and mercury concentrations (Appendix 3), the statistical conclusion was rejected as a type alpha error. Instead, it was concluded that the fish were from the same population and that a regression could thus justifiably be developed from combined (1978 to 1982) data. The combined data regression [µgHg/g = 1.21 x 10^{-3}(g weight of fish) + 0.23] showed a significant (r^2 = 0.39) association between fish size and muscle tissue mercury concentrations (Table 4). Thus, it was estimated that Portage la Prairie sauger could be expected to exceed the 0.50 µg/g level at approximately 225g, and the 1.0 µg/g level at approximately 640g (Table 4). The observed frequency at which sauger exceeded the 0.50 µg/g level during the entire biomonitoring period was 64%; less then 2% exceeded the 1.0 µg/g level.

Twenty northern pike were sampled in 1981 and ranged in size from 370g to 3510g. Muscle tissue mercury concentrations varied from 0.08 µg/g to 1.36 µg/g, with a mean of 0.38 µg/g (Table 1). Fifteen pike were sampled in 1982 and ranged in size from 1020g to 4980g. The mercury concentrations varied from 0.25 µg/g to 1.30 µg/g, with a mean of 0.84 µg/g (Table 2). Like sauger, analysis of variance (Table 3) suggested that the annual means differed significantly. Unlike sauger, differences in annual means could not be attributed solely to different sizes of fish sampled as considerable size overlap occurred between each of the years excepting 1979. As no trend other than wide annual fluctuations was apparent, differences in annual means were thought likely to be an anomaly. Therefore, a regression [µgHg/g = 2.02×10^{-4}(g weight of fish) + 0.18] was developed from combined data (1978 to 1982) and was found to show a significant (r^2 = 0.41) association between mercury concentrations and fish weight (Table 4). Weights at which northern pike could be expected to exceed the 0.50 µg/g and 1.0 µg/g levels were estimated at approximately 1600g and 4100g, respectively (Table 4). However, it should be emphasized that the validity of the regression procedure appears uncertain in this instance.

Ten shorthead redhorse suckers were sampled during both the 1981 and 1982 Biomonitoring Programs. These fish ranged in size from 370g to 1460g and from 400g to 1580g, respectively. The 1981 mercury concentrations varied from 0.17 µg/g to 1.01 µg/g, with a mean of 0.59 µg/g (Table 1). Five (50%) of the fish sampled had mercury

concentrations in excess of 0.50 µg/g; one (10%)had concentrations in excess of the 1.0 µg/g level. During 1982, mercury concentrations were much lower with a range of 0.21 µg/g to 0.37 µg/g and a mean of 0.29 µg/g (Table 2). As suggested by the 1981 and 1982 values, analysis of variance indicated that significant differences existed between the 1978 to 1982 annual means (Table 3). The significant differences were not attributable to size differences as analysis of variance of annual regression estimated values (Table 3) also indicated that significant differences were present. Furthermore, the regression of combined (1978 to 1982) data showed no significant association (r^2 = 0.17) between muscle tissue mercury concentrations and fish size (Table 4). Because a trend in annual means was not evident, a more definitive statement must await further sampling.

Walleye were first included in the Biomonitoring Program at Portage la Prairie in 1980. Ten, ranging in size from 200g to 1620g, were collected and sampled in 1981. Muscle tissue mercury concentrations varied from 0.17 µg/g to 0.75 µg/g, with a mean of 0.38 µg/g (Table 1). Two (20%) fish exceeded the 0.50 µg/g level. During 1982 only three walleye were collected. Each of these possessed muscle tissue mercury concentrations in excess of the 0.50 µg/g level as the mercury concentrations varied from 0.70 µg/g to 1.55 µg/g with a mean of 1.10 µg/g (Table 2). Although analysis of variance suggested significant differences occurred between the annual means (Table 3), the differences in both observed and estimated means appeared due to the size-skewed 1982

data. Thus, a regression of combined (1980 to 1982) data could justifiably be developed. This regression [μgHg/g = 3.72 x 10^{-4}(g weight of fish) + 0.18] showed a significant (r^2 = 0.67) mercury to fish weight association and suggested that Portage la Prairie walleye might be expected to exceed the 0.50 μg/g and 1.0 μg/g levels at approximately 880g and 2200g, respectively (Table 4). Regarding actual walleye sampled during the 1980-1982 biomonitoring period, the frequency of mercury concentrations in excess of the 0.50 μg/g and 1.0 μg/g levels were 41% and 6%, respectively.

Channel catfish were collected and sampled solely in 1981. Both specimens were relatively small (930g and 1850g) and both possessed relatively low (0.22 μg/g and 0.30 μg/g, respectively) muscle tissue mercury concentrations.

B. THE RED RIVER

Three sites, Emerson, St. Norbert and Selkirk (Figure 1), are biomonitored. Each has been included in the program since 1978.

B.1 EMERSON

An intensive sport fishery has not developed at Emerson. The angling that does occur is directed primarily towards freshwater drum, sauger and goldeye. Occassional landings of walleye, northern pike and channel catfish also generate some interest. Although the local sport fishery is not intensive, Biomonitoring is conducted at Emerson because the site is an international boundary water downstream of which intensive sport fisheries have developed.

Sauger have been sampled on a regular basis since 1978. During 1981 fifteen sauger, ranging in size from 40g to 710g, were sampled. Muscle tissue mercury concentrations varied from 0.22 µg/g to 0.81 µg/g, with a mean of 0.49 µg/g (Table 1). Six (40%) of these fish possessed muscle tissue mercury concentrations in excess of 0.50 µg/g. Twenty sauger, ranging in size from 40g to 520g, were sampled in 1982. Muscle tissue mercury concentrations varied from 0.12 µg/g to 0.71 µg/g, with a mean of 0.38 µg/g (Table 2). Six (30%) of these fish possessed mercury concentrations in excess of the 0.50 µg/g level. The mean frequency of mercury concentrations greater than 0.50 µg/g was 49% for the 1978 to 1982 biomonitoring period. Levels in excess of 1.0 µg/g were not found. Though differences in the observed annual mean (1978 to 1982) were significant, analysis of variance performed on regression estimated values (Table 3) evidenced no significant differences. This suggested that the differences in observed values were due to annual differences in the sizes of fish sampled. The regression [µgHg/g = 4.37×10^{-4}(g weight of fish) + 0.38] developed from combined (1978 to 1982) data, though poorly correlated ($r^2 = 0.08$), was found to show a significant fish weight to mercury concentration association at a 95% level of confidence (Table 4). Thus, the weight at which Emerson Sauger might be expected to exceed the 0.50 µg/g level was estimated at 290g (Table 4).

Goldeye are by far the most abundant sport fish present at the Emerson site and have been biomonitored at the rate of 10 samples per year since 1978. The 1981 fish ranged in size from

200g to 540g. Muscle tissue mercury concentrations varied from 0.11 µg/g to 0.65 µg/g, with a mean of 0.29 µg/g (Table 1). Two (20%) fish exceeded the 0.50 µg/g level. Goldeye sampled in 1982 varied in size from 180g to 420g. Mercury concentrations ranged from 0.05 µg/g to 0.50 µg/g with a mean of 0.29 µg/g (Table 2). Annual means exhibited no significant differences since inception of the Biomonitoring Program (Table 3). The regression [µgHg/g = 1.10×10^{-3}(g weight of fish) - 0.04] developed from combined (1978 to 1982) data showed a significant ($r^2 = 0.28$) association between fish weight and muscle tissue mercury concentrations (Table 4). Thus, it was estimated that goldeye from Emerson might be expected to exceed the 0.50 µg/g level at approximately 480g (Table 4). The mean frequency of concentrations in excess of the 0.50 µg/g level was 8% during the entire biomonitoring period.

Six walleye were collected and sampled in 1981. These fish ranged in size from 360g to 2120g. Muscle tissue mercury concentrations varied from 0.32 µg/g to 0.58 µg/g with a mean of 0.48 µg/g (Table 1). Three (50%) specimens exceeded the 0.50 µg/g level. During 1982 a total of eight walleye ranging in size from 360g to 920g, were sampled. Muscle tissue mercury concentrations varied from 0.27 µg/g to 0.76 µg/g with a mean of 0.56 µg/g (Table 2). Five (63%) of these fish exceeded the 0.50 µg/g level. Significant differences between both observed and estimated annual means (Table 3) were attributed to the 1979 small sample (N = 4) of size-skewed data. The regression [µgHg/g = 4.70×10^{-4}(g weight of fish) + 0.19] developed from combined data (1978 to 1982) showed a significant

(r^2 = 0.67) association of mercury concentrations to fish weight (Table 4). Thus, weights at which Emerson walleye could be expected to exceed the 0.50 µg/g, 1.0 µg/g and 1.5 µg/g levels were estimated at approximately 680g, 1780g and 2800g, respectively (Table 4). The mean frequencies of observed concentrations exceeding these levels were 50%, 6% and 6%, respectively, for the 1978 to 1982 biomonitoring period.

Freshwater drum were first sampled on a regular basis in 1980. Like walleye, considerable difficulty in obtaining an adequate sample size has since been experienced. During 1981 six freshwater drum, ranging in size from 280g to 1560g, were sampled. Muscle tissue mercury concentrations varied from 0.13 µg/g to 0.55 µg/g with a mean of 0.31 µg/g (Table 1). Two (33%) of the fish possessed mercury concentrations above the 0.50 µg/g level. Eight fish ranging in size from 150g to 940g were sampled in 1982. Mercury concentrations were somewhat lower and ranged from 0.06 µg/g to 0.40 µg/g with a mean of 0.15 µg/g (Table 2). Though significant differences between observed annual (1980 to 1982) means occurred, analysis of variance performed on regression estimated values (Table 3) suggested that the differences were caused by sampling different mean sizes of fish each year. Therefore, a regression could justifiably be developed from combined (1980 to 1982) data. This regression [µgHg/g = 2.68×10^{-4}(g weight of fish) + 0.05] showed a significant (r^2 = 0.44) mercury concentration to fish weight association (Table 4). It was estimated from the regression that freshwater drum of the size range encountered at

Emerson during the 1980 to 1982 biomonitoring period would not normally be expected to exceed the 0.50 µg/g level (Table 4). The observed frequency of levels in excess of 0.50 µg/g was 8%, half of which resulted from a fish slightly larger than the tabulated regression projections.

Northern pike have been biomonitored on an irregular basis whenever specimens were netted. One specimen was collected in 1981. This was a large pike (3650g) with a surprisingly low muscle tissue mercury concentration (0.23 µg/g). Five pike, ranging in size from 600g to 1980g, were sampled in 1982. Muscle tissue mercury concentrations varied from 0.18 µg/g to 1.12 µg/g with a mean of 0.60 µg/g (Table 2). Four (80%) of these fish possessed mercury concentrations in excess of the 0.50 µg/g level. Significant differences occurred between the 1980 to 1982 means (Table 3) presumeably due to the small sample sizes compared. Additionally, a significant regression could not be developed from combined (1980 to 1982) data (Table 4). Thus only the period (1980 to 1982) mean concentration and the mean frequency of concentrations in excess of 0.50 µg/g could be provided. These were 0.48 µg/g and 50%, respectively.

Channel catfish and carp are also sampled on an irregular basis. During 1981 five catfish, ranging in size from 1500g to 6810g, were sampled. Muscle tissue mercury concentrations varied from 0.18 µg/g to 0.97 µg/g, with a mean of 0.48 µg/g (Table 1). Two (40%) fish exceeded the 0.50 µg/g level. A significant (r^2 = 0.78) regression [µgHg/g = 1.39 x 10^{-4}(g weight of fish) - 0.05] developed from the data suggested that Emerson catfish

could be expected to exceed the 0.50 ug level at a weight of 4000g (Table 4). Channel catfish were not collected in 1982.

Nine carp ranging in size from 380g to 1300g were sampled in 1982. Mercury concentrations varied from 0.03 µg/g to 0.43 µg/g, with a mean of 0.23 µg/g (Table 2). A significant (r^2 = 0.39) regression could not be developed from the data (Table 4).

B.2 ST. NORBERT

The St. Norbert biomonitoring site is located near the floodway gate/bridge complex. Thus, public accessibility as well as a good fish population have contributed to the development of a popular sport fishery. Sauger, freshwater drum and goldeye appear to be the predominant species taken by anglers. Northern pike, walleye and channel catfish are landed somewhat less frequently. Species biomonitored on a regular basis since inception of the Biomonitoring Program include sauger, common sucker and goldeye.

Sixteen sauger, ranging in size from 60g to 520g, were sampled in 1981. Muscle tissue mercury concentrations varied from 0.16 µg/g to 0.95 µg/g, with a mean of 0.58 µg/g (Table 1). Twelve (75%) fish exceeded the 0.50 µg/g level. During 1982 a total of nineteen sauger were sampled. These fish ranged in size from 120g to 740g, and in mercury concentrations from 0.17 µg/g to 0.70 µg/g (Table 1). The mean mercury concentration (0.33 µg/g) was somewhat lower than in previous years as only three (16%) fish exceeded the 0.50 µg/g level (Table 2). Analysis of variance performed on annual (1978 to 1982) observed and regression estimated data indicated that

significant differences not attributable to the size of fish sampled were present between the means (Table 3). Furthermore, a combined (1978 to 1982) data regression failed to show a significant (r^2 = <0.01) association between mercury concentration and fish weight (Table 4). Although the data appear to suggest a negative trend (declining) in muscle tissue mercury concentrations, the period of record is not sufficiently lengthy for confirmation at the present time.

Ten common suckers were sampled during each of 1981 and 1982. The 1981 fish ranged in size from 740g to 1040g. Muscle tissue mercury concentrations varied from 0.06 µg/g to 0.27 µg/g with a mean of 0.14 µg/g (Table 1). The 1982 fish were slightly smaller, ranging from 600g to 980g. Mercury concentrations varied from 0.12 µg/g to 0.41 µg/g, with a mean of 0.22 µg/g (Table 2). Analysis of variance (Table 3) indicated that significant differences occurred between the annual (1978 to 1982) means and that the differences were not attributable to size of fish sampled. Indeed, the common suckers showed no evidence of a correlation (r^2 = 0.04) between fish size and mercury concentrations (Table 4). Nevertheless, it is important to note that none of the common suckers sampled to date exceeded the 0.50 µg/g level and that all annual means to the present have not exceeded 0.30 µg/g.

Twenty goldeye were sampled in 1981. These ranged in size from 200g to 580g. Muscle tissue mercury concentrations varied from 0.09 µg/g to 0.85 µg/g with a mean of 0.34 µg/g (Table 1). Five (25%) of the fish exceeded the 0.50 µg/g level. Ten goldeye were

sampled in 1982, none of which exceeded the 0.50 µg/g level. These fish ranged in size from 200g to 340g and possessed mercury concentrations ranging from 0.07 µg/g to 0.49 µg/g with a mean of 0.23 µg/g (Table 2). Analysis of variance indicated that significant differences were not present between the annual means of 1978 to 1982 (Table 3). Goldeye also demonstrated a significant association (r^2 = 0.36) of mercury concentrations to fish weight for the regression [µgHg/g = 1.01 x 10^{-3}(g weight of fish) - 0.01] (Table 4). Estimations derived from the regression suggested that goldeye of the size range normally encountered at St. Norbert might not be expected to exceed the 0.50 µg/g level unless the fish are larger than approximately 500g in size (Table 4). The mean frequency of concentrations greater than the 0.50 µg/g level for the 1978 to 1982 biomonitoring period was 10% of all (60) goldeye sampled. None exceeded the 1.0 µg/g level.

Walleye are sampled on an irregular basis. Nine walleye, ranging from 400g to 1600g, were sampled in 1981. Muscle tissue mercury concentrations varied from 0.15 µg/g to 0.64 µg/g with a mean of 0.33 µg/g (Table 1). Only one (11%) fish exceeded the 0.50 µg/g level. During 1982 only five walleye were collected and sampled. These ranged in size from 40g to 3000g. Muscle tissue mercury concentrations varied from 0.42 µg/g to 1.31 µg/g with a mean of 0.88 µg/g (Table 2). Four (80%) of these fish exceeded the 0.50 µg/g level and two (40%) exceeded the 1.0 µg/g level. Because of the large variances associated with each of the annual (1980 to 1982) means, significant differences were not observed

between the annual means (Table 3). Also, the large size range contributed to the development of a significant (r^2 = 0.75) regression [µgHg/g = 4.33 x 10^{-4}(g weight of fish) + 0.14] showing a strong association of muscle tissue mercury concentrations to fish weight (Table 4). The weight at which St. Norbert walleye might be expected to exceed the 0.50 µg/g, 1.0 µg/g and 1.5 µg/g levels were estimated at approximately 825g, 1950g and 3150g, respectively (Table 4). The mean frequency at which these mercury concentrations were exceeded since 1980 were 38%, 17%, and 4%, respectively.

Four northern pike, all exceeding the 0.50 µg/g level, were sampled in 1982. These fish ranged in size from 430g to 1920g. Muscle tissue mercury concentrations varied from 0.58 µg/g to 1.00 µg/g, with a mean of 0.79 µg/g (Table 2). None were collected in 1981. A significant difference was not observed between the 1980 and the 1982 annual means (Table 3). However, probably due to small sample sizes, a significant (r^2 = 0.04) correlation between mercury concentration and fish weight could not be developed (Table 4). The mean frequency of northern pike exceeding the 0.50 µg/g level to date averaged 75%, but the total sample size (N = 8) is small and could be misleading.

Small numbers of channel catfish have been sampled since 1980. The 1981 fish (N = 3) ranged in size from 1100g to 4960g. Mercury concentrations varied from 0.19 µg/g to 0.81 µg/g with a mean of 0.40 µg/g (Table 1). One fish (33%) exceeded the 0.50 µg/g level. Four catfish were sampled in 1982. These ranged in size from 1010g to 5220g. Muscle tissue mercury concentrations

varied from 0.08 µg/g to 1.41 µg/g with a mean of 0.48 µg/g (Table 2). Again only one (25%) fish exceeded the 0.50 µg/g level. A significant difference between the means of 1980 to 1982 was not observed (Table 3). The regression [µgHg/g = 2.52 x 10^{-4}(g weight of fish) - 0.09] developed from combined (1980 to 1982) data showed a significant association (r^2 = 0.68) between mercury concentrations and fish weight (Table 4). Thus, it was estimated that St. Norbert channel catfish might be expected to exceed the 0.50 µg/g and 1.0 µg/g levels at weights greater than approximately 2350g and 4400g, respectively (Table 4). The mean frequencies of mercury concentrations exceeding these levels were 30% and 20%, respectively, for the period of record.

Freshwater drum were sampled only in 1982. Seven fish, ranging in size from 80g to 400g, were sampled. Muscle tissue mercury concentrations varied from 0.05 µg/g to 0.31 µg/g with a mean of 0.20 µg/g (Table 2). A significant regression (r^2 = 0.03) could not be developed from the data (Table 4).

Carp have been sampled irregularly in 1980 and 1981. The single 1981 fish weighed 6140g and possessed a muscle tissue mercury concentration of 0.31 µg/g. Combination of 1980 and 1981 data produced a well correlated (r^2 = 0.61) but non significant regression (Table 4).

B.3 SELKIRK

The Selkirk area supports what is perhaps the most intensive sport fishery in the Province of Manitoba (G. Nelson, pers. comm.).

The success of the fishery is maintained by influxes of fish from the south basin of Lake Winnipeg. Large numbers of trophy fish of several species landed annually and numerous angling derbies have helped to popularize this portion of the Red River for sport fishing. Primary target species vary from season to season with freshwater drum being taken in early summer, sauger and channel catfish throughout the summer and walleye through the fall and winter months. Goldeye, northern pike, yellow perch and white bass are also landed regularly.

Freshwater drum have been biomonitored on a routine basis since 1978. Ten fish, ranging in size from 400g to 990g, were sampled during 1981. Muscle tissue mercury concentrations ranged from 0.08 µg/g to 0.25 µg/g, with a mean of 0.15 µg/g (Table 1). Only nine fish were sampled during 1982. They ranged in size from 510g to 1180g. Muscle tissue mercury concentrations were similar to 1981 as they varied from 0.05 µg/g to 0.29 µg/g with a mean of 0.19 µg/g (Table 2). Significant differences between the 1978 to 1982 annual means were not observed (Table 3). The regression [$\mu gHg/g = 1.07 \times 10^{-4}$(g weight of fish) + 0.08] developed from combined (1978 to 1982) data demonstrated a poorly correlated but significant ($r^2 = 0.11$) association between mercury concentrations and fish weight (Table 4). Thus, it was estimated that freshwater drum of the size range normally encountered at Selkirk would not be expected to exceed the 0.50 µg/g mercury level (Table 4). This estimation was well supported by the data as none of the fourty-nine fish actually sampled to date exceeded the 0.50 µg/g level.

Sauger have also been routinely biomonitored since 1978. Twenty sauger ranging in size from 50g to 670g were sampled during 1981. Muscle tissue mercury concentrations varied from 0.11 µg/g to 1.08 µg/g with a mean of 0.48 µg/g (Table 1). Nine (45%) fish exceeded the 0.50 µg/g level and one (5%) exceeded the 1.0 µg/g level. During 1982 a further twenty sauger were sampled. The size range of 100g to 580g was somewhat narrower than that of 1981. Mercury concentrations varied from 0.10 µg/g to 0.71 µg/g, with a mean of 0.24 µg/g (Table 2). Only one (5%) fish exceeded the 0.50 µg/g level. Although analysis of variance (Table 3) suggested that the 1978 to 1982 annual means differed significantly, the statistical conclusion was rejected as a type alpha error on the basis of size-skewed data. Therefore, a regression [µgHg/g = 9.20 x 10^{-4}(g weight of fish) + 0.20] was developed from combined (1978 to 1982) data (Table 4). Though not well correlated (r^2 = 0.28), the regression showed a significant association of mercury concentrations to fish weight. Thus, it was estimated that sauger from Selkirk might be expected to exceed the 0.50 µg/g mercury level at a weight of approximately 330g (Table 4). The mean frequency of sauger exceeding this level during the 1978 to 1982 biomonitoring period was 35%. Only one (1%) fish exceeded the 1.00 µg/g level during this entire period. The long term (1978-1982) mean mercury concentration was 0.40 µg/g.

Common suckers have been routinely biomonitored at the rate of ten samples annually since the 1978 inception of the Biomonitoring Program. The 1981 fish ranged in size from 880g to 1510g. Muscle

tissue mercury concentrations varied from 0.06 µg/g to 0.24 µg/g with a mean of 0.13 µg/g (Table 1). The 1982 fish ranged in size from 750g to 1800g. Mercury concentrations varied from 0.08 µg/g to 0.38 µg/g with a mean of 0.19 µg/g (Table 2). Significant differences between the 1978 to 1982 annual means were not detected (Table 3). The regression [µgHg/g = 1.04×10^{-4}(g weight of fish) + 0.03] developed from combined (1978 to 1982) data was poorly correlated (r^2 = 0.12) but did show a significant association of mercury concentrations to fish weight (Table 4). The regression suggested that Selkirk common sucker of the size range normally encountered would not be expected to exceed the 0.50 µg/g level (Table 4). Indeed, levels in excess of 0.50 µg/g were not observed during the 1978 to 1982 period.

Walleye have been biomonitored since 1980. Twenty walleye were sampled during 1981 and eight during 1982. The 1981 fish ranged in size from 340g to 1200g while the 1982 fish ranged from 580g to 1560g. The 1981 muscle tissue mercury concentrations varied from 0.15 µg/g to 0.42 µg/g with a mean of 0.25 µg/g (Table 1). The 1982 mercury concentrations varied from 0.13 µg/g to 0.36 µg/g with a mean of 0.24 µg/g (Table 2). Though a significant difference was noted between the observed 1980 to 1982 annual means, analysis of variance performed on regression estimated values suggested that the difference was attributable to the generally larger sized fish sampled in 1980 (Table 3). The regression [µgHg/g = 2.29×10^{-4}(g weight of fish) + 0.10] developed from combined (1980 to 1982) data showed a significant (r^2 = 0.54) association between fish weight and mercury

concentrations (Table 4). Thus, it was estimated that Selkirk walleye might be expected to exceed the 0.50 µg/g level at weights greater than approximately 1750g (Table 4). The mean frequency at which walleye exceeded the 0.50 µg/g level during the 1980 to 1982 period was 8%. Mercury levels in excess of 1.0 µg/g were not recorded.

Northern pike were sampled only during 1981. These ten fish ranged in size from 800g to 2060g. Muscle tissue mercury concentrations varied from 0.16 µg/g to 0.42 µg/g with a mean of 0.30 µg/g (Table 1). A significant regression (r^2 = 0.04) could not be developed from the data (Table 4).

White bass, carp and goldeye were sampled only during 1982. Six white bass ranging in size from 320g to 420g were sampled. Muscle tissue mercury concentrations varied from 0.06 µg/g to 0.11 µg/g with a mean of 0.08 µg/g (Table 2). A significant regression (r^2 = 0.04) could not be developed from the data. Ten carp ranging in size from 300g to 1980g were sampled. Mercury concentrations varied from 0.02 µg/g to 0.04 µg/g with a mean of 0.03 µg/g (Table 2). Again a significant regression (r^2 = 0.23) could not be developed from the data (Table 4). The seven goldeye sampled ranged in size from 180g to 500g. Muscle tissue mercury concentrations varied from 0.09 µg/g to 0.44 µg/g with a mean of 0.16 µg/g (Table 2). A significant (r^2 = 0.87) regression was developed and suggested that goldeye of the size range normally encountered at Selkirk would not be expected to exceed the 0.50 µg/g level (Table 4).

C. THE WINNIPEG RIVER

Two sites, Pointe du Bois and Lac du Bonnet, have been biomonitored since the 1978 inception of the program. Biomonitoring of the Eaglenest Lake area was initiated in 1981.

C.1 EAGLENEST LAKE

Eaglenest Lake is accessed either by float equipped aircraft or by a 40 kilometre boat trip from Pointe du Bois. Hence, it is not fished as intensively as more accessible stretches of the Winnipeg River. Two lodges located on the lake cater to anglers pursuing walleye, northern pike and smallmouth bass.

Walleye were sampled at the rate of twenty fish per year. The 1981 specimens ranged in size from 250g to 1920g. Muscle tissue mercury concentrations varied from 0.34 µg/g to 2.75 µg/g with a mean of 1.06 µg/g (Table 1). Fifteen (75%) fish exceeded the 0.50 µg/g level, eleven (55%) exceeded the 1.0 µg/g level and two (10%) exceeded the 1.5 µg/g level. The 1982 specimens ranged in size from 220g to 3060g. Mercury concentrations varied from 0.45 µg/g to 1.90 µg/g with a mean of 1.00 µg/g (Table 1). Seventeen (85%) fish exceeded the 0.50 µg/g level, eight (40%) the 1.0 µg/g level and three (15%) the 1.5 µg/g level. A significant difference was not detected between the 1981 and 1982 means (Table 3). The regression [µgHg/g = 3.75×10^{-4}(g weight of fish) + 0.65] developed from combined (1981 and 1982) data was not well correlated ($r^2 = 0.22$) but did show a significant association of mercury concentrations to fish weight (Table 4). Thus, it was

estimated that most Eaglenest Lake walleye might be expected to exceed the 0.50 µg/g level and that fish weighing greater than approximately 925g and 2250g might be expected to exceed the 1.0 µg/g and 1.5 µg/g levels, respectively (Table 4). However, both the poor correlation (r^2 = 0.22) and the mean frequency (20%) of walleye possessing muscle tissue mercury concentrations of less than the 0.50 µg/g level suggest that some adjustment to the regression may be necessary in order to better define the Eaglenest Lake situation.

Although twenty specimens per year was the objective, only eight northern pike were captured and sampled during each year. The 1981 specimens ranged in size fom 280g to 1420g. Muscle tissue mercury concentrations varied from 0.27 µg/g to 1.57 µg/g with a mean of 0.91 µg/g (Table 1). Five (63%) fish exceeded the 0.50 µg/g level, four (50%) the 1.0 µg/g level and one (13%) exceeded the 1.5 µg/g level. The 1982 specimens ranged in size from 440g to 6280g. Mercury concentrations varied from 0.36 µg/g to 2.60 µg/g, with a mean of 1.02 µg/g (Table 2). Seven (88%) pike exceeded the 0.50 µg/g level, three (38%) exceeded the 1.0 µg/g level and one (13%) exceeded the 1.5 µg/g level. A significant difference between the 1981 and 1982 means was not detected (Table 3). The combined (1981 and 1982) data regression [$\mu gHg/g = 3.62 \times 10^{-4}$(g weight of fish) + 0.50] showed a significant (r^2 = 0.69) association of mercury concentrations to fish weight (Table 4). Thus, it was estimated that most northern pike might be expected to exceed the 0.50 µg/g level and that fish

weighing more than approximately 1350g and 2750g might be expected to exceed the 1.0 µg/g and 1.5 µg/g levels, respectively (Table 4). However, like walleye, the mean frequency (25%) of pike possessing mercury concentrations less than the 0.50 µg/g level, suggests that some adjustment to the regression may be necessary in order to better define existing conditions.

Common suckers are an abundant species in Eaglenest Lake and are monitored at the rate of ten specimens per year. The 1981 specimens ranged in size from 640g to 1380g. Muscle tissue mercury concentrations varied from 0.09 µg/g to 0.31 µg/g with a mean of 0.21 µg/g (Table 1). The 1982 specimens were generally larger and ranged in size from 780g to 1720g. Muscle tissue mercury concentrations were also somewhat greater and varied from 0.15 µg/g to 0.63 µg/g with a mean of 0.33 µg/g (Table 2). Two (20%) fish exceeded the 0.50 µg/g level. A significant difference was not detected between the 1981 and 1982 means (Table 3). The combined data (1981 and 1982) regression [µgHg/g = 2.64×10^{-4}(g weight of fish) - 0.02] was not well correlated ($r^2 = 0.27$) but did show a significant association of mercury concentrations to fish weight. The regression indicated that common suckers of the size range normally encountered at Eaglenest Lake would not be expected to exceed the 0.50 µg/g level (Table 4). Because this does not compare well with the observed mean frequency (10%) of concentrations in excess of the 0.50 µg/g level, some adjustments to the regression may be necessary.

Although smallmouth bass are commonly taken by anglers, only one specimen was collected during 1982. This specimen weighed 610g and possessed a muscle tissue mercury concentration of 0.71 µg/g (Table 2).

A single burbot was also collected in 1982. This fish weighed 1120g and had a muscle tissue mercury concentration of 0.51 µg/g (Table 2).

Two cisco, weighing 360g and 420g, were also collected in 1982. Muscle tissue mercury concentrations varied from 0.18 µg/g to 0.28 µg/g (Table 2).

C.2 POINTE DU BOIS

Anglers in the vicinity of Pointe du Bois focus their attention primarily upon walleye and large pike. Mooneye are becoming more popular as a sought after species during the early summer. Smallmouth bass and yellow perch appear to be landed on an incidental basis.

Mooneye have been biomonitored at the rate of ten fish per year routinely since 1978. During 1981 the specimens ranged in size from 360g to 630g. Muscle tissue mercury concentrations varied from 0.15 µg/g to 0.82 µg/g with a mean of 0.38 µg/g (Table 1). One (10%) fish exceeded the 0.50 µg/g level. The 1982 specimens ranged in size from 320g to 560g. Muscle tissue mercury concentrations varied from 0.13 µg/g to 0.60 µg/g with a mean of 0.26 µg/g (Table 2). Again one (10%) fish exceeded the 0.50 µg/g level. Significant differences between the annual (1978 to 1982) mean

mercury concentrations were not detected (Table 3). The regression [$\mu gHg/g = 1.03 \times 10^{-3}$ (g weight of fish) - 0.11] developed from combined (1978 to 1982) data showed a significant ($r^2 = 0.32$) association of mercury concentrations to fish weight (Table 4). Thus, it was estimated that mooneye might be expected to exceed the 0.50 µg/g mercury level at a weight greater than approximately 590g (Table 4). This compares well with the 1978 to 1982 data where a mean frequency of 14% of the mooneye possessed mercury concentrations in excess of the 0.50 µg/g level. During this same period only one (2%) specimen exceeded the 1.0 µg/g level.

Northern pike have been biomonitored routinely since 1978 but it has not always been possible to collect a minimum sample size of ten specimens. Eleven specimens ranging in size from 340g to 4550g were collected in 1981. Muscle tissue mercury concentrations varied from 0.18 µg/g to 1.20 µg/g with a mean of 0.52 µg/g (Table 1). Four (36%) fish exceeded the 0.50 µg/g level and one (9%) exceeded the 1.0 µg/g level. During 1982 only nine fish were sampled. Most were larger fish as the size ranged from 800g to 7340g. Accordingly, muscle tissue mercury concentrations were also somewhat greater and varied from 0.55 µg/g to 1.70 µg/g with a mean of 1.07 µg/g (Table 2). All of these specimens exceeded the 0.50 µg/g level, five (56%) exceeded the 1.0 µg/g level and one (11%) exceeded the 1.5 µg/g level. Although the observed annual means differed significantly, analysis of variance performed on annual regression estimated values suggested that the differences were due to the annual mean size of fish sampled (Table 3). Therefore, a regression

[$\mu gHg/g = 1.25 \times 10^{-4}$ (g weight of fish) + 0.45] showing a significant ($r^2 = 0.43$) association of mercury concentrations to fish weight was developed from combined (1978 to 1982) data (Table 4). It was estimated from the regression that northern pike might be expected to exceed the 0.50 µg/g level at weights greater than approximately 500g and that the 1.0 µg/g level might be exceeded in fish over approximately 4600g (Table 4). The mean frequencies at which northern pike were observed to exceed the 0.50 µg/g, 1.0 µg/g, and 1.5 µg/g levels during the 1978 to 1982 biomonitoring term were 66%, 20% and 3%, respectively.

Common suckers have been biomonitored at the rate of ten fish per year since inception of the program. The 1981 specimens ranged in size from 930g to 1810g. Muscle tissue mercury concentrations varied from 0.07 µg/g to 0.68 µg/g with a mean of 0.32 µg/g (Table 1). Two (20%) fish exceeded the 0.50 µg/g level. The 1982 specimens ranged in size from 1080g to 1800g. Muscle tissue mercury concentrations varied from 0.19 µg/g to 1.70 µg/g* with a mean of 0.46 µg/g (Table 2). Two (20%) fish again exceeded the 0.50 µg/g level.

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*The high value (1.70 µg/g) recorded appeared beyond the range generally encountered with common suckers. Although re-analysis confirmed the original result and the value has been included in the statistical calculations, it is still viewed with considerable suspicion.

Significant differences between the 1978 to 1982 annual means were not detected (Table 3). The regression [$\mu gHg/g = 2.89 \times 10^{-4}$ (g weight of fish) + 0.02] developed from combined (1978 to 1982) data showed a significant ($r^2 = 0.22$) association of mercury concentrations to fish weight (Table 4). Thus, it was estimated that common suckers larger than approximately 1675g might be expected to possess muscle tissue mercury concentrations in excess of 0.50 µg/g (Table 4).

Walleye were included with the Biomonitoring Program in 1980. The 1981 sample consisted of twenty specimens ranging in size from 340g to 1500g. Muscle tissue mercury concentrations varied from 0.22 µg/g to 0.72 µg/g with a mean of 0.37 µg/g (Table 1). Two (4%) fish exceeded the 0.50 µg/g level. During 1982 fourteen walleye were sampled. These specimens ranged in size from 560g to 2720g. The muscle tissue mercury concentrations varied from 0.41 µg/g to 1.59 µg/g with a mean of 0.72 µg/g (Table 2). Seven (50%) fish exceeded the 0.50 µg/g level and four (29%) exceeded the 1.0 µg/g level. One (7%) fish, the largest, exceeded the 1.5 µg/g level. Like the northern pike, significant differences between the observed 1980 to 1982 means were attributable to sampling significantly different sizes of fish each year (Table 3). The regression [$\mu gHg/g = 4.55 \times 10^{-4}$(g weight of fish) + 0.09] developed from combined (1980 to 1982) data showed a significant and well correlated ($r^2 = 0.81$) association of mercury concentrations to fish weight (Table 4). Thus, it was estimated that Pointe du Bois

walleye might be expected to exceed the 0.50 µg/g and 1.0 µg/g mercury levels at weights greater than approximately 900g and 2000g, respectively (Table 4). The mean frequencies at which these levels were exceeded during the 1980 to 1982 period were 27% and 12%, respectively. Only one (2%) fish exceeded the 1.5 µg/g level.

Two smallmouth bass were collected during 1982. These specimens weighed 760g and 1200g and possessed muscle tissue mercury concentrations of 0.64 µg/g and 1.08 µg/g, respectively (Table 2). Though it is evident that mercury may occur at elevated levels in this species, the extent of the problem must await future definition.

C.3 LAC DU BONNET

Walleye, sauger and northern pike receive heavy angling pressure in the Lac du Bonnet area. Mooneye is also a species popular with many anglers during the early summer. Landings of other species such as yellow perch, rock bass and smallmouth bass appear incidental.

Mooneye have been routinely biomonitored at the rate of ten fish per year since the program's inception. The 1981 specimens ranged in size from 370g to 660g. Muscle tissue mercury concentrations varied from 0.15 µg/g to 0.41 µg/g with a mean of 0.23 µg/g (Table 1). During 1982 the specimens were of a similar size, ranging from 360g to 740g. Again no fish exceeded the 0.50 µg/g level as mercury concentrations varied from 0.10 µg/g to 0.37µg/g with a mean of 0.16 µg/g (Table 2). Significant differences between the 1978 to 1982 annual mean mercury

concentrations were not detected (Table 3). A regression [μgHg/g = 3.02 x 10^{-4}(g weight of fish) + 0.06] developed from combined (1978 to 1980) data showed a significant (r^2 = 0.22) association of mercury concentrations to fish weight (Table 4). Estimations from the regression (Table 4) indicated that mooneye of the size range normally encountered in Lac du Bonnet were not expected to exceed the 0.50 μg/g level.

Lake whitefish have also been sampled routinely at the rate of ten specimens per year since the program's inception. The 1981 specimens ranged in size from 620g to 1340g. Muscle tissue mercury concentrations were low and ranged from 0.06 μg/g to 0.23 μg/g with a mean of 0.12 μg/g (Table 1). The 1982 specimens varied more than those of previous years as weights ranged from 500g to 1520g. Muscle tissue mercury concentrations were lower than 1981 and varied from <0.02 μg/g to 0.07 μg/g with a mean of 0.04 μg/g (Table 2). Significant differences between the annual means of the 1978 to 1982 biomonitoring period were detected (Table 3). These were partially attributable to size differences in the fish sampled each year (Table 4). However, some of the differences between annual means was also attributable to the narrow range of mercury concentrations encountered during the 1979 and 1982 biomonitoring periods. Thus, the validity of developing a regression from combined data was uncertain. Nevertheless, it may be stated that Lac du Bonnet whitefish do not at present possess excessive muscle tissue mercury concentrations since both the highest mercury concentration encountered since 1978 (0.23 μg/g) and the highest annual mean encountered since 1978 (0.12 μg/g) are well below the 0.50 μg/g level.

Sauger have also been routinely biomonitored since the program's inception. Eleven sauger were collected and sampled during the 1981 program. These fish ranged in size from 80g to 350g. Muscle tissue mercury concentrations varied from 0.35 µg/g to 1.39 µg/g with a mean of 0.89 µg/g (Table 1). Ten (91%) specimens exceeded the 0.50 µg/g level and four (36%) exceeded the 1.0 µg/g level. Unlike previous years, none of the specimens exceeded the 1.5 µg/g level. During 1982 only eight sauger were collected despite considerable netting effort. These specimens ranged in size from 30g to 560g. Muscle tissue mercury concentrations varied from 0.37 µg/g to 1.40 µg/g with a mean of 0.87 µg/g (Table 2). Six (75%) fish exceeded the 0.50 µg/g level and three (38%) exceeded the 1.0 µg/g level. Again, none of the specimens exceeded the 1.5 µg/g level. Significant differences not attributable to size variations were detected among the annual means of the 1978 to 1982 period (Table 3). These differences corresponded to a negative (declining) trend in muscle tissue mercury concentrations. Because mean mercury concentrations appeared to be declining, a valid regression could not legitimately be developed from combined data. Thus, mercury concentrations could not be estimated for specific weights of Lac du Bonnet sauger. Nevertheless, it appeared that sauger of this area will continue to possess mean mercury concentration in excess of the 0.50 µg/g level for some time to come.

Walleye were first included with the Biomonitoring Program in 1980. During 1981 a total of twenty specimens were sampled. These ranged in size from 400g to 2800g. Muscle tissue mercury concentrations varied from 0.37 µg/g to 1.31 µg/g with a mean of 0.67 µg/g (Table 1). Thirteen (65%) of the specimens exceeded the 0.50 µg/g level and two (10%) exceeded the 1.0 µg/g level. None exceeded the 1.5 µg/g level. The thirteen 1982 specimens ranged in size from 300g to 1600g. Muscle tissue mercury concentrations varied from 0.38 µg/g to 1.57 µg/g with a mean of 0.72 µg/g (Table 2). Nine (69%) walleye exceeded the 0.50 µg/g level, three (23%) exceeded the 1.0 µg/g level and one (8%) exceeded the 1.5 µg/g level. Significant differences were not detected between the 1980 to 1982 annual means (Table 3). A regression [µgHg/g = 2.73×10^{-4}(g weight of fish) + 0.43] was developed from combined (1980 to 1982) data and showed a significant ($r^2 = 0.33$) association of mercury concentrations to fish weight (Table 4). Thus, it was estimated that walleye larger than approximately 500g and 2100g might be expected to exceed the 0.50 µg/g and 1.0 µg/g levels, respectively (Table 4). The mean frequencies at which the 0.50 µg/g, 1.0 µg/g and 1.5 µg/g levels were exceeded during the 1980 to 1982 term were 74%, 14% and 2%, respectively.

Northern pike were included with the Biomonitoring Program in 1980. Seven specimens ranging in size from 650g to 1940g were sampled in 1981. Muscle tissue mercury concentrations in these fish varied from 0.24 µg/g to 0.69 µg/g with a mean of 0.43 µg/g (Table 1). Only one (14%) fish exceeded the 0.50 µg/g level. During 1982 four

pike, ranging in size from 740g to 2620g, were sampled. Muscle tissue mercury concentrations varied from 0.31 µg/g to 1.32 µg/g with a mean of 0.78 µg/g (Table 2). Three (75%) specimens exceeded the 0.50 µg/g level and one (25%) exceeded the 1.0 µg/g level. Significant differences were not detected between the 1980 to 1982 annual means (Table 3). The regression [µgHg/g = 2.53 x 10^{-4}(g weight of fish) + 0.13] developed from combined (1980 to 1982) data showed a significant (r^2 = 0.53) association of mercury concentrations to fish weight (Table 4). Thus, it was estimated that Lac du Bonnet pike might be expected to exceed the 0.50 µg/g level at weights greator than approximately 1500g (Table 4). The mean frequencies at which pike exceeded the 0.50 µg/g and 1.0 µg/g levels during the 1980 to 1982 term were 44% and 6%, respectively.

Yellow perch were added to the Biomonitoring Program in 1981. The ten 1981 specimens ranged in size from 220g to 500g. Muscle tissue mercury concentrations varied from 0.17 µg/g to 0.57 µg/g with a mean of 0.31 µg/g (Table 1). Only one (10%) specimen exceeded the 0.50 µg/g level. Two specimens were collected during 1982. These weighed 320g and 400g and possessed muscle tissue mercury concentrations of 0.14 µg/g and 0.20 µg/g, respectively. A significant difference was not detected between the two annual mean mercury concentrations (Table 3). However, because of the small number of specimens, a significant (r^2 = 0.19) regression could not be developed from the combined data (Table 4).

Common suckers were sampled only during 1981. These seven specimens ranged in size from 880g to 1700g. Muscle tissue mercury

concentrations varied from 0.05 µg/g to 0.44 µg/g with a mean of 0.17 µg/g (Table 1). A regression [µgHg/g = 4.03×10^{-4} (g weight of fish) - 0.31] was developed and showed a significant (r^2 = 0.79) association of muscle tissue mercury concentrations to fish weight (Table 4). Thus, it was estimated that common suckers of the size range normally encountered in Lac du Bonnet are not expected to possess muscle tissue mercury concentrations in excess of the 0.50 µg/g level (Table 4).

Shorthead redhorse suckers have been sampled irregularly since 1980. Ten specimens, ranging in size from 580g to 1140g, were sampled during the 1982 program. Muscle tissue mercury concentrations were low and varied from 0.06 µg/g to 0.47 µg/g with a mean of 0.17 µg/g (Table 2). A significant difference between the 1980 and 1982 means was not detected. A regression [µgHg/g = 5.59×10^{-4} (g weight of fish) - 0.19] was developed from the combined (1980 and 1982) data and showed a significant (r^2 = 0.81) association of muscle tissue mercury concentrations to fish weight (Table 4). Thus, it was estimated that shorthead redhorse suckers of the size range normally encountered in Lac du Bonnet are not expected to exceed the 0.50 µg/g mercury level (Table 4).

Burbot were sampled only in 1982. These ten specimens ranged in size from 680g to 1400g. Muscle tissue mercury concentrations were suprisingly low for a piscivorous species and varied from 0.06 µg/g to 0.47 µg/g with a mean of 0.17 µg/g (Table 2). A well correlated (r^2 = 0.81) regression [µgHg/g = 6.44×10^{-4}(g weight of fish) - 0.31] was developed and showed a significant association of mercury

concentrations to fish weight (Table 4). Thus, it was estimated that burbot weighing less than approximately 1250g would not be expected to possess muscle tissue mercury concentrations in excess of the 0.50 µg/g level (Table 4).

A single smallmouth bass was collected and sampled in 1982. This specimen weighed 740g and possessed a muscle tissue mercury concentration of 0.73 µg/g (Table 2).

D. THE SOURIS RIVER

The Souris River has been biomonitored at the Town of Souris since 1979. Walleye, northern pike and yellow perch are the only sport fish species occurring at the site in numbers sufficient to generate interest among anglers. Local youngsters frequently angle for the numerous bullheads but these generally are not retained. Additionally, a spring dip net fishery has developed for common suckers during the annual spawning runs. Walleye, common suckers and brown bullhead have been routinely sampled since inception of the Biomonitoring Program at the Souris site.

Twenty walleye were collected during the 1981 program. The specimens ranged in size from 450g to 2400g. Muscle tissue mercury concentrations varied from 0.40 µg/g to 1.29 µg/g with a mean of 0.69 µg/g (Table 1). Fourteen (70%) fish exceeded the 0.50 µg/g level and 2 (10%) exceeded the 1.0 µg/g level. None possessed mercury concentrations in excess of 1.5 µg/g. During the 1982 program, only two walleye were collected.* These fish weighed 920g and 1100g and possessed muscle tissue mercury concentrations of

0.82 µg/g and 0.88 µg/g, respectively (Table 2). Despite the small 1982 sample, significant differences were not detected between the 1979 to 1982 annual means (Table 3). The regression [µgHg/g = 4.18×10^{-4} (g weight of fish) + 0.34] developed from combined (1979 to 1982) data showed a significant ($r^2 = 0.55$) association of muscle tissue mercury concentrations to fish weight (Table 4). Thus, it was estimated that most Souris walleye could be expected to possess muscle tissue mercury concentrations in excess of the 0.50 µg/g level and that fish larger than approximately 1950g might possess concentrations greater than 1.0 µg/g (Table 4). The mean frequencies at which these levels were exceeded during the 1979 to 1982 period were 73% and 8%, respectively.

Common suckers were sampled at the rate of ten specimens per year. The specimens collected during 1981 ranged in size from 690g to 1070g. Muscle tissue mercury concentrations varied from 0.27 µg/g to 0.67 µg/g with a mean of 0.51 µg/g (Table 1). Six (60%) of the specimens exceeded the 0.50 µg/g level. The specimens collected during 1982 ranged in size from 640g to 1120g. Muscle tissue mercury concentrations varied from 0.18 µg/g to 0.85 µg/g with a mean of 0.50 µg/g (Table 2). Five (50%) of the fish exceeded the 0.50 µg/g level. Significant differences between the 1979 to 1982 annual means were not detected (Table 3). A poorly correlated

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*The poor catch was attributed to a mid-winter (1982) oxygen depletion as the total catch declined by approximately 95% despite doubled netting effort.

(r^2 = 0.13) regression [µgHg/g = 4.71 x 10^{-4}(g weight of fish) + 0.09] was developed from the combined (1979 to 1982) data and showed a significant association of mercury concentrations to fish weight (Table 4). Thus, it was estimated that Souris common suckers might be expected to exceed the 0.50 µg/g level at weights greater than approximately 875g (Table 4). The mean frequency at which common suckers exceeded the 0.50 µg/g level during the 1979 to 1982 term was 45%. None of the fish exceeded the 1.0 µg/g level.

Brown bullheads were also sampled at the rate of ten specimens per year. The 1981 specimens ranged in size from 220g to 340g. Muscle tissue mercury concentrations varied from 0.31 µg/g to 0.74 µg/g with a mean of 0.47 µg/g (Table 1). Six (60%) specimens exceeded the 0.50 µg/g level. During 1982 the specimens ranged in size from 120g to 500g. The muscle tissue mercury concentrations varied from 0.29 to 0.68 µg/g with a mean of 0.43 µg/g (Table 2). Two (20%) of the specimens possessed mercury concentrations in excess of the 0.50 µg/g level. Significant differences between the 1979 to 1982 means were detected but were attributable to variations in the mean weights of fish sampled (Table 3). However, a significant regression could not be developed from combined (1979 to 1982) data (Table 4). The long term (1979 to 1982) mean mercury concentration (0.50 µg/g) and the mean frequency of Brown Bullheads exceeding the 0.50 µg/g level (38%) were perhaps the most definitive descriptions applicable to a small sized species such as this.

Northern pike have been biomonitored on an irregular basis since 1980. Three specimens ranging in size from 270g to 740g were

sampled during 1981. Muscle tissue mercury concentrations varied from 0.34 µg/g to 0.38 µg/g with a mean of 0.37 µg/g (Table 1). Four specimens ranging in size from 400g to 820g were sampled during 1982. Muscle tissue mercury concentrations varied from 0.41 µg/g to 0.67 µg/g with a mean of 0.50 µg/g (Table 2). This volume of data was insufficient to permit a valid interpretation.

Three yellow perch ranging in size from 240g to 280g were sampled during 1982. Muscle tissue mercury concentrations varied from 0.33 µg/g to 0.43 µg/g with a mean of 0.39 µg/g (Table 2). Again the volume of data was insufficient to permit evaluation.

CONCLUSIONS

It is concluded that:

1. Mean mercury concentrations in the muscle tissue of most fish species biomonitored during 1981 and 1982 showed little statistically significant change from those of 1978, 1979 and 1980.
2. Mean mercury concentrations in the muscle tissue of sauger from Lac du Bonnet appear to be experiencing a negative trend (i.e. concentrations appear to be declining). However, the mean 1982 concentrations (0.87 µg/g) are still in excess of the 0.50 µg/g level.
3. The weights at which some species of fish might be expected to exceed the 0.50 µg/g mercury level may be estimated from regressions showing a significant association between fish weight and muscle tissue mercury concentrations. Biomonitored fish thus estimated to exceed the 0.50 µg/g mercury level include:

- Walleye:	at Lake of the Prairies	- weights greater than approximately 625g;
	at Brandon	- weights greater than approximately 575g;
	at Portage la Prairie	- weights greater than approximately 880g;
	at Emerson	- weights greater than approximately 680g;
	at St. Norbert	- weights greater than approximately 825g;
	at Selkirk	- weights greater than approximately 1750g;
	at Eaglenest Lake	- most Walleye ;
	at Pointe du Bois	- weights greater than approximately 900g;
	at Lac du Bonnet	- weights greater than approximately 1500g;
	at Souris	- most Walleye;

-Northern Pike:	at Portage la Prairie	- weights greater than approximately 1600g;
	at Eaglenest Lake	- most Northern Pike;
	at Point du Bois	- weights greater than approximately 500g;
	at Lac du Bonnet	- weights greater than approximately 1500g;
-Sauger:	at Portage la Prairie	- weights greater than approximately 225g;
	at Emerson	- weights greater than approximately 290g;
	at Selkirk	- weights greater than approximately 330g;
-Goldeye:	at Emerson	- weights greater than approximately 480g;
	at St. Norbert	- weights greater than approximately 500g;
-Mooneye:	at Point du Bois	- weights greater than approximately 590g;
-Channel Catfish:	at Emerson	- weights greater than approximately 4000g;
	at St. Norbert	- weights greater than approximately 2350g;
-Burbot:	at Lac du Bonnet	- weights greater than approximately 1250g;
-Common Sucker:	at Point du Bois	- weights greater than approximately 1675g;
	at Souris	- weights greater than approximately 875g;

4. The weights at which some species of fish might be expected to exceed the 1.0 µg/g mercury level may also be estimated from regressions showing a significant association between fish weight and muscle tissue mercury concentrations. Biomonitored fish thus estimated to exceed the 1.0 µg/g mercury level include:

-Walleye:	at Lake of the Priaries	- weights greater than approximately 1875g;
	at Brandon	- weights greater than approximately 1825g;
	at Portage la Prairie	- weights greater than approximately 2200g;
	at Emerson	- weights greater than approximately 1780g;
	at St. Norbert	- weights greater than approximately 1950g;

	at Eaglenest Lake	- weights greater than approximately 925g;
	at Pointe du Bois	- weights greater than approximately 2000g;
	at Lac du Bonnet	- weights greater than approximately 2100g;
	at Souris	- weights greater than approximately 1950g;
-Northern Pike:	at Portage la Prairie	- weights greater than approximately 4100g;
	at Eaglenest Lake	- weights greater than approximately 1350g;
	at Point du Bois	- weights greater than approximately 4600g;
-Sauger:	at Portage la Prairie	- weights greater than approximately 640g;
-Channel Catfish:	at St. Norbert	- weights greater than approximately 4400g;

5. The weights at which some species of fish might be expected to exceed the 1.5 µg/g mercury level may also be estimated from regressions showing a significant association between fish weight and muscle tissue mercury concentrations. Biomonitored fish thus estimated to exceed the 1.5 µg/g mercury level include:

-Walleye:	at Emerson	- weights greater than approximately 2800g;
	at St. Norbert	- weights greater than approximately 3150g;
	at Eaglenest Lake	- weights greater than approximately 2250g;
-Northern Pike:	at Eaglenest Lake	- weights greater than approximately 2750g;

6. Fish species which have been biomonitored routinely for at least three years since 1978 and which have consistently exhibited annual mean mercury concentrations lower than the 0.50 µg/g level included:

-Walleye at Selkirk;
-Freshwater drum at Emerson and Selkirk;

-Goldeye at Emerson and St. Norbert;
-Mooneye at Brandon, Pointe du Bois and Lac du Bonnet;
-Lake Whitefish at Lac du Bonnet;
-Common Sucker at Brandon, St. Norbert, Selkirk and Pointe du Bois.

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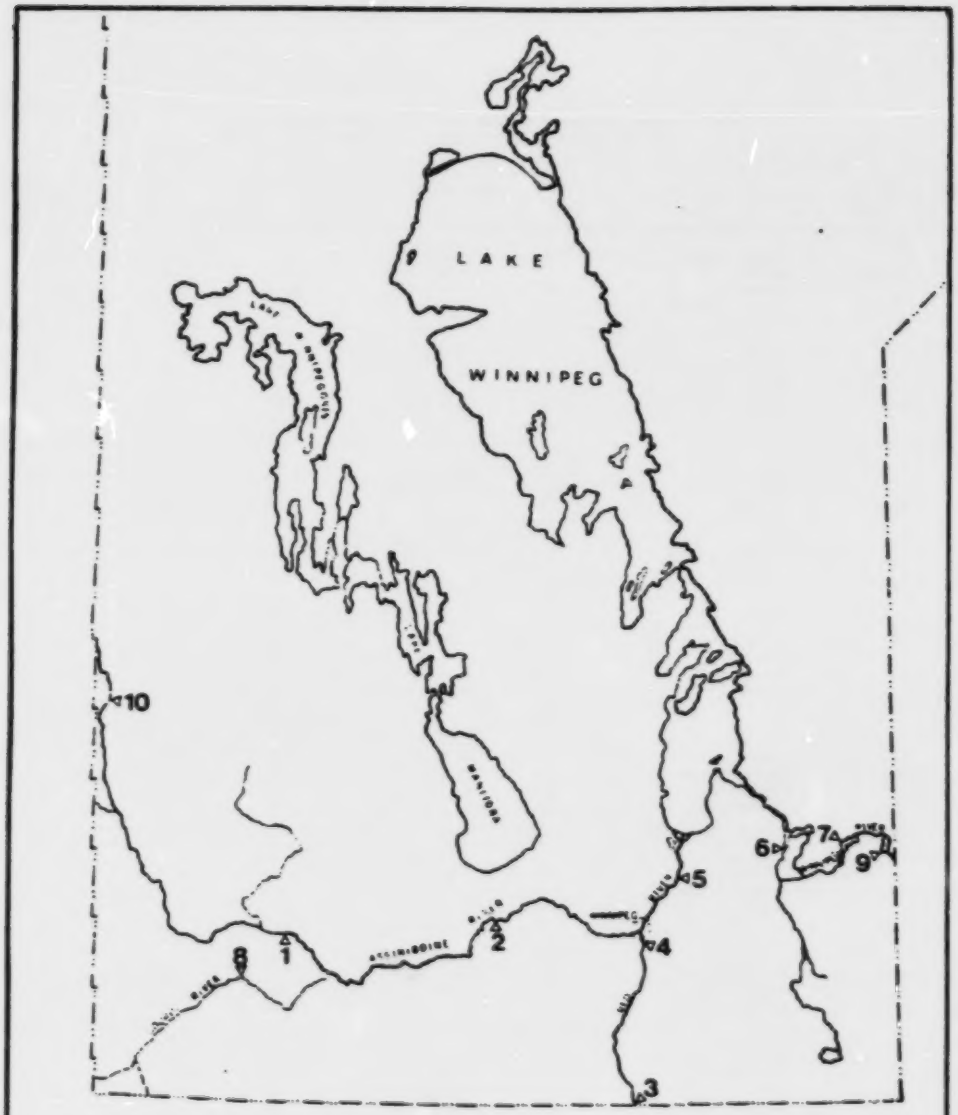

Biomonitoring Sites

1. Brandon
2. Portage la Prairie
3. Emerson
4. St. Norbert
5. Selkirk
6. Lac du Bonnet
7. Point du Bois
8. Souris
9. Englenest Lake
10. Lake of the Prairies

Figure 1: Location of Biomonitoring Sites.

TABLE 1: SUMMARIZATION OF MERCURY ANALYSIS OF FISH MUSCLE TISSUE SAMPLES COLLECTED DURING THE 1981 BIOMONITORING PROGRAM

RIVER	LOCATION	SPECIES	N	MEAN ± S.E. (µg/g)	HI (µg/g)	LO (µg/g)	FREQUENCY I>0.50 µg/g
A		Common Sucker	10	0.30 ± 0.04	0.53	0.11	1
S	Brandon	Rhoneye	10	0.38 ± 0.04	0.53	0.16	2
S		Walleye	10	0.64 ± 0.10	1.45	0.30	8
I		Channel Catfish	1	0.24	----	----	0
N							
I							
B		Sauger	5	0.90 ± 0.25	1.81	0.33	4
O	Portage	Northern Pike	20	0.38 ± 0.06	1.36	0.08	4
I	la	Shorthead Redhorse Sucker	10	0.59 ± 0.10	1.01	0.17	5
N	Prairie	Channel catfish	2	0.26 ± 0.18	0.30	0.22	0
E		Walleye	10	0.38 ± 0.12	0.75	0.17	2
		Sauger	15	0.49 ± 0.05	0.81	0.22	6
		Goldeye	10	0.29 ± 0.05	0.65	0.11	2
	Emerson	Walleye	6	0.48 ± 0.20	0.58	0.32	3
		Freshwater drum	6	0.31 ± 0.13	0.55	0.13	2
		Northern Pike	1	0.23	----	----	0
		Channel Catfish	5	0.48 ± 0.21	0.97	0.18	2
R							
		Sauger	16	0.58 ± 0.06	0.95	0.16	12
		Common Sucker	10	0.14 ± 0.02	0.27	0.06	0
R	St. Norbert	Goldeye	20	0.34 ± 0.05	0.85	0.09	5
		Carp	1	0.31	----	----	0
		Channel Catfish	3	0.40 ± 0.23	0.81	0.19	1
		Walleye	9	0.33 ± 0.05	0.64	0.15	1
D							
		Freshwater drum	10	0.15 ± 0.02	0.25	0.08	0
		Sauger	20	0.48 ± 0.06	1.08	0.11	9
	Selkirk	Common Sucker	10	0.13 ± 0.02	0.24	0.06	0
		Walleye	20	0.25 ± 0.01	0.42	0.15	0
		Northern Pike	10	0.30 ± 0.03	0.42	0.16	0
	Eaglenest	Walleye	20	1.06 ± 0.14	2.75	0.34	15
	Lake	Northern Pike	8	0.91 ± 0.18	1.57	0.27	5
W		Common Sucker	10	0.21 ± 0.03	0.31	0.09	0
I							
		Rhoneye	10	0.38 ± 0.06	0.82	0.15	1
N	Pointe du	Northern Pike	11	0.52 ± 0.09	1.20	0.18	4
	Bois	Common Sucker	10	0.32 ± 0.06	0.68	0.07	2
N		Walleye	20	0.37 ± 0.02	0.72	0.22	2
I							
		Rhoneye	10	0.23 ± 0.03	0.41	0.15	0
P		Whitefish	10	0.13 ± 0.02	0.23	0.06	0
	Lac du	Sauger	11	0.89 ± 0.10	1.39	0.35	10
E	Bonnet	Walleye	20	0.67 ± 0.05	1.31	0.37	13
		Yellow Perch	10	0.31 ± 0.04	0.57	0.17	1
C		Northern Pike	7	0.43 ± 0.05	0.69	0.24	2
		Common Sucker	7	0.17 ± 0.05	0.44	0.05	0
E							
O		Walleye	20	0.89 ± 0.05	1.29	0.40	14
U	Souris	Common Sucker	10	0.51 ± 0.05	0.67	0.27	6
R		Brown Bullhead	10	0.47 ± 0.04	0.74	0.31	6
I		Northern Pike	3	0.37 ± 0.01	0.38	0.34	0
E							

TABLE 2: SUMMARIZATION OF MERCURY ANALYSIS OF FISH MUSCLE TISSUE SAMPLES COLLECTED DURING THE 1982 BIOMONITORING PROGRAM

RIVER	SITE	SPECIES	N	MEAN ± S.E. (µg/g)	HI (µg/g)	LO (µg/g)	FREQUENCY X>0.50 µg/g
ASSINIBOINE	Portage la Prairie	WALLEYE	20	0.62 ± 0.06	1.20	0.22	13
		COMMON SUCKER	10	0.19 ± 0.01	0.23	0.13	0
		SHORTHEAD REDHORSE SUCKER	10	0.09 ± 0.01	0.13	0.03	0
		NORTHERN PIKE	1	0.28 ± 0	0.28	0.28	0
		YELLOW PERCH	1	0.07 ± 0	0.07	0.07	0
ASSINIBOINE	Brandon	COMMON SUCKER	10	0.19 ± 0.04	0.32	0.04	0
		GOLDEYE	10	0.18 ± 0.03	0.35	0.07	0
		WALLEYE	11	0.59 ± 0.14	1.60	0.16	5
		NORTHERN PIKE	3	0.42 ± 0.21	0.83	0.21	1
		CHANNEL CATFISH	6	0.15 ± 0.04	0.29	0.04	0
		SHORTHEAD REDHORSE SUCKER	10	0.20 ± 0.04	0.54	0.08	1
		LOCK BASS	3	0.21 ± 0.06	0.32	0.12	0
ASSINIBOINE	Portage la Prairie	SAUGER	10	0.29 ± 0.01	0.38	0.24	0
		NORTHERN PIKE	15	0.84 ± 0.07	1.30	0.25	14
		SHORTHEAD REDHORSE SUCKER	10	0.29 ± 0.02	0.37	0.21	0
		WALLEYE	3	1.10 ± 0.25	1.35	0.70	3
RED	EMERSON	SAUGER	20	0.38 ± 0.05	0.71	0.12	6
		GOLDEYE	10	0.29 ± 0.06	0.50	0.05	0
		WALLEYE	8	0.56 ± 0.07	0.76	0.27	5
		FRESHWATER DRUM	7	0.15 ± 0.04	0.40	0.06	0
		NORTHERN PIKE	5	0.60 ± 0.15	1.12	0.18	4
		CARP	9	0.23 ± 0.05	0.43	0.03	0
RED	St. Norbert	SAUGER	19	0.33 ± 0.03	0.70	0.17	3
		COMMON SUCKER	10	0.22 ± 0.03	0.41	0.12	0
		GOLDEYE	10	0.23 ± 0.05	0.49	0.07	0
		WALLEYE	5	0.88 ± 0.17	1.31	0.42	4
		NORTHERN PIKE	4	0.79 ± 0.09	1.00	0.58	4
		CHANNEL CATFISH	4	0.48 ± 0.32	1.41	0.08	1
		WALLEYE-SAUGER HYBRID	1	0.80 ± 0	0.80	0.80	1
		FRESHWATER DRUM	7	0.20 ± 0.04	0.31	0.05	0
RED	Selkirk	FRESHWATER DRUM	9	0.19 ± 0.03	0.29	0.05	0
		SAUGER	20	0.24 ± 0.03	0.71	0.10	1
		COMMON SUCKER	10	0.19 ± 0.04	0.38	0.08	0
		WALLEYE	8	0.24 ± 0.03	0.36	0.13	0
		WHITE BASS	6	0.08 ± 0.01	0.11	0.06	0
		CARP	10	0.03 ± 0.003	0.04	0.02	0
		GOLDEYE	7	0.16 ± 0.05	0.44	0.09	0
WINNIPEG	Eagle-nest Lake	WALLEYE	20	1.00 ± 0.09	1.90	0.45	17
		NORTHERN PIKE	8	1.02 ± 0.25	2.60	0.34	7
		COMMON SUCKER	10	0.33 ± 0.05	0.63	0.15	2
		SMALLMOUTH BASS	1	0.71 ± 0	0.71	0.71	1
		BURBOT	1	0.51 ± 0	0.51	0.51	0
		CISCO	2	0.23 ± 0.05	0.28	0.18	0
WINNIPEG	Pointe du Bois	SUCKER	10	0.26 ± 0.05	0.60	0.13	1
		NORTHERN PIKE	9	1.07 ± 0.12	1.70	0.55	9
		COMMON SUCKER	10	0.46 ± 0.14	1.70	0.19	2
		WALLEYE	14	0.72 ± 0.10	1.59	0.41	7
		SMALLMOUTH BASS	2	0.88 ± 0.20	1.08	0.68	2
WINNIPEG	Lac du Bonnet	SUCKER	10	0.16 ± 0.03	0.37	0.10	0
		WHITEFISH	10	0.04 ± 0.01	0.07	<0.02	0
		SAUGER	8	0.87 ± 0.12	1.40	0.37	6
		WALLEYE	13	0.72 ± 0.10	1.57	0.38	9
		NORTHERN PIKE	4	0.78 ± 0.21	1.32	0.31	3
		SHORTHEAD REDHORSE SUCKER	10	0.17 ± 0.05	0.47	0.06	0
		SMALLMOUTH BASS	1	0.73 ± 0	0.73	0.73	1
		YELLOW PERCH	2	0.17 ± 0.03	0.20	0.14	0
		BURBOT	10	0.17 ± 0.05	0.47	0.06	0
SOURIS	Souris	WALLEYE	2	0.85 ± 0.03	0.88	0.82	2
		COMMON SUCKER	10	0.50 ± 0.08	0.85	0.18	5
		BROWN BULLHEAD	10	0.43 ± 0.04	0.68	0.29	2
		NORTHERN PIKE	4	0.58 ± 0.06	0.67	0.41	2
		YELLOW PERCH	3	0.39 ± 0.03	0.43	0.33	0

TABLE 3: ANALYSIS OF VARIANCE TO DETERMINE DIFFERENCES IN ANNUAL MEAN MERCURY LEVELS OF BIOMONITORED FISH.*

SITE	SPECIES	COMPARISON PERIOD	OBSERVED MERCURY F	df	F.95	ESTIMATED MERCURY F	df	F.95
BRADEN	COMMON SUCKER	1978 - '82	2.19	4,43	2.61	—	—	—
	WALLEYE	1978 - '82	0.38	4,48	2.58	—	—	—
	NORTHERN PIKE	1980 + 1982	1.96	1,8	5.32	—	—	—
PORTAGE	SAUGER	1978 - '82	9.18	4,50	2.57	4.08	4,15	3.06
	NORTHERN PIKE	1978 - '82	7.34	4,39	2.53	16.22	4,15	3.06
	SHORTHEAD REDHORSE SUCKER	1978 - '82	9.44	4,45	2.60	5.21	4,15	3.06
	WALLEYE	1980 - '82	11.05	2,14	3.74	28.76	2,9	4.26
EMERSON	SAUGER	1978 - '82	5.07	4,46	2.52	2.11	4,15	3.06
	GOLDEYE	1978 - '82	1.45	4,45	2.60	—	—	—
	WALLEYE	1978 - '82	6.44	4,26	2.74	5.60	4,15	3.06
	FRESHWATER DRUM	1980 - '82	4.77	2,20	3.49	2.61	2,9	4.26
	NORTHERN PIKE	1980 + 1982	0.93	1,9	5.12	—	—	—
ST. ROSE	SAUGER	1978 - '82	9.31	4,69	2.49	12.38	4,15	3.06
	COMMON SUCKER	1978 - '82	4.63	4,44	2.60	4.09	4,15	3.06
	GOLDEYE	1978 - '82	2.01	4,55	2.54	—	—	—
	WALLEYE	1980 - '82	1.89	2,21	3.47	—	—	—
	NORTHERN PIKE	1980 + 1982	0.17	1,6	5.99	—	—	—
	CHANNEL CATFISH	1980 - '82	0.03	1,5	6.61	—	—	—
SELKIRK	FRESHWATER DRUM	1978 - '82	1.31	4,44	2.60	—	—	—
	SAUGER	1978 - '82	3.71	4,75	2.44	3.32	4,15	3.06
	COMMON SUCKER	1978 - '82	0.94	4,45	2.60	—	—	—
	WALLEYE	1980 - '82	10.54	2,35	3.27	3.38	2,9	4.26
GLADSTONE	WALLEYE	1981 - '82	0.15	1,38	4.08	—	—	—
	NORTHERN PIKE	1981 - '82	0.12	1,14	4.60	—	—	—
	COMMON SUCKER	1981 - '82	4.45	1,17	4.45	2.44	1,6	5.99
PINAWA	WALLEYE	1978 - '82	1.87	4,45	2.60	—	—	—
	NORTHERN PIKE	1978 - '82	4.27	4,53	2.54	2.18	4,15	3.06
	COMMON SUCKER	1978 - '82	1.93	4,45	2.60	—	—	—
	WALLEYE	1980 - '82	7.94	2,38	3.23	0.81	2,9	4.26
LAC DU BONNET	WALLEYE	1978 - '82	1.78	4,45	2.60	—	—	—
	WHITEFISH	1978 - '82	6.30	4,45	2.60	3.67	4,15	3.06
	SAUGER	1978 - '82	4.19	4,53	2.57	3.88	4,15	3.06
	WALLEYE	1980 - '82	0.43	2,40	3.23	—	—	—
	NORTHERN PIKE	1980 - '82	3.15	2,15	3.68	—	—	—
	YELLOW PERCH	1981 - '82	2.89	1,10	4.96	—	—	—
	SHORTHEAD REDHORSE SUCKER	1980 + 1982	2.85	1,18	4.41	—	—	—
SOURIS	WALLEYE	1979 - '82	1.59	3,36	2.88	—	—	—
	COMMON SUCKER	1979 - '82	0.54	3,36	2.88	—	—	—
	BROWN BULLHEAD	1979 - '82	3.23	3,36	2.88	0.69	3,12	3.49
	NORTHERN PIKE	1980 - '82	19.45	2,6	5.14	39.05	2,9	4.26

*Data for comparisons with 1978, 1979 and 1980 were extracted from Bock, 1980; 1981; and 1982.

TABLE 4: REGRESSIONS OF WEIGHT VS. MERCURY CONCENTRATIONS AND REGRESSION ESTIMATED MERCURY CONCENTRATIONS FOR SPECIFIC WEIGHTS OF FISH BIOMONITORED SINCE 1978.

SITE	SPECIES	DATA FROM	REGRESSION WHERE µgHg/g = b(wt)+a a	b	r^2	ASSOCIATION SIGNIFICANCE WHERE H_0: B= 0 at t= = 0.05	ESTIMATED µg/g AT WEIGHT:							
LAKE OF THE PRAIRIES	WALLEYE	1982	0.26	3.91×10^{-4}	0.65	SIGNIFICANT	500g 0.45	750g 0.55	1000g 0.65	1250g 0.75	1500g 0.85	1750g 0.95	2000g 1.05	2250g 1.15
	COMMON SUCKER	1982	0.29	-7.57×10^{-5}	0.12	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	SHORTHEAD REDHORSE SUCKER	1982	0.003	6.88×10^{-5}	0.73	SIGNIFICANT	— —	750g 0.05	1000g 0.07	1250g 0.09	1500g 0.11	1750g 0.13	— —	— —
BRANDON	COMMON SUCKER	1978 - 1982	0.01	2.93×10^{-4}	0.20	SIGNIFICANT	500g 0.16	750g 0.24	1000g 0.31	1250g 0.38	— —	— —	— —	— —
	MOONEYE	1978 - 1982	0.02	7.57×10^{-4}	0.17	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	WALLEYE	1978 - 1982	0.28	3.80×10^{-4}	0.47	SIGNIFICANT	250g 0.38	500g 0.47	750g 0.57	1000g 0.66	1250g 0.76	1500g 0.85	2000g 1.04	3000g 1.43
	NORTHERN PIKE	1980 + 1982	0.11	2.42×10^{-4}	0.18	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	CHANNEL CATFISH	1981 - 1982	0.04	1.07×10^{-4}	0.78	SIGNIFICANT	500g 0.09	750g 0.11	1000g 0.14	1250g 0.17	1500g 0.20	1750g 0.22	2000g 0.25	2250g 0.27
	SHORTHEAD REDHORSE SUCKER	1982	-0.11	5.26×10^{-4}	0.45	SIGNIFICANT	— —	400g 0.10	500g 0.15	600g 0.20	700g 0.26	800g 0.31	— —	— —
	ROCK BASS	1982	0.17	1.73×10^{-4}	0.01	NOT SIGNIFICANT	—	—	—	—	—	—	—	—
PORTAGE LA PRAIRIE	SAUGER	1978 - 1982	0.23	1.21×10^{-3}	0.39	SIGNIFICANT	100g 0.35	200g 0.47	300g 0.59	400g 0.71	500g 0.84	600g 0.96	700g 1.08	— —
	NORTHERN PIKE	1978 - 1982	0.18	2.02×10^{-4}	0.41	SIGNIFICANT	500g 0.28	1000g 0.38	1500g 0.48	2000g 0.58	2500g 0.68	3000g 0.78	3500g 0.88	4000g 0.99
	SHORTHEAD REDHORSE SUCKER	1978 - 1982	0.11	3.04×10^{-4}	0.17	NOT SIGNFCANT	— —	— —	— —	— —	— —	— —	— —	— —
	WALLEYE	1980 - 1982	0.18	3.72×10^{-4}	0.67	SIGNIFICANT	250g 0.27	500g 0.36	750g 0.46	1000g 0.55	1500g 0.74	2000g 0.92	2500g 1.11	3000g 1.29
	CHANNEL CATFISH	1981	0.14	8.70×10^{-5}	1.00	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
RIVERTON	SAUGER	1978 - 1982	0.38	4.37×10^{-4}	0.08	SIGNIFICANT	100g 0.42	200g 0.47	300g 0.51	400g 0.55	500g 0.60	600g 0.64	700g 0.69	— —
	GOLDEYE	1978 - 1982	-0.04	1.10×10^{-3}	0.28	SIGNIFICANT	— —	150g 0.13	200g 0.18	250g 0.23	300g 0.29	350g 0.35	400g 0.40	450g 0.46
	WALLEYE	1978 - 1982	0.19	4.70×10^{-4}	0.67	SIGNIFICANT	— —	500g 0.42	750g 0.54	1000g 0.66	1500g 0.89	2000g 1.13	2500g 1.37	3000g 1.60
	FRESHWATER DRUM	1980 - 1982	0.05	2.68×10^{-4}	0.44	SIGNIFICANT	200g 0.11	400g 0.16	600g 0.21	800g 0.27	1000g 0.32	1250g 0.39	1500g 0.44	— —
	NORTHERN PIKE	1980 - 1982	0.48	-2.56×10^{-7}	<0.01	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	CHANNEL CATFISH	1981	-0.05	1.39×10^{-4}	0.78	SIGNIFICANT	— —	1000g 0.09	2000g 0.23	3000g 0.36	4000g 0.50	5000g 0.64	6000g 0.78	— —

TABLE 4: REGRESSIONS OF WEIGHT VS. MERCURY CONCENTRATIONS AND REGRESSION ESTIMATED MERCURY CONCENTRATIONS FOR SPECIFIC WEIGHTS OF FISH BIOMONITORED SINCE 1978, CONTINUED.

SITE	SPECIES	DATA FROM	REGRESSION WHERE $\mu g Hg/g = b(wt)+a$ a	b	r^2	ASSOCIATION SIGNIFICANCE WHERE $H_0: B = 0$ at $b = 0.05$	ESTIMATED µg/g AT WEIGHT:							
	CARP	1982	-0.03	3.02×10^{-4}	0.39	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	SAUGER	1978 - 1982	0.46	1.12×10^{-4}	<0.01	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	COMMON SUCKER	1978 - 1982	0.08	1.24×10^{-4}	0.04	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	GOLDEYE	1978 - 1982	-0.01	1.01×10^{-3}	0.36	SIGNIFICANT	100g 0.09	150g 0.14	200g 0.19	250g 0.34	300g 0.29	350g 0.34	400g 0.40	450g 0.45
ST. NORBERT	WALLEYE	1980 - 1982	0.14	4.33×10^{-4}	0.75	SIGNIFICANT	250g 0.25	500g 0.36	750g 0.47	1000g 0.57	1500g 0.79	2000g 1.01	2500g 1.44	4000g 1.87
	NORTHERN PIKE	1980 + 1982	0.61	1.18×10^{-4}	0.04	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	CHANNEL CATFISH	1980 - 1982	-0.09	2.52×10^{-4}	0.68	SIGNIFICANT	1000g 0.16	1500g 0.29	2000g 0.41	2500g 0.54	3000g 0.67	3500g 0.80	4000g 0.92	5000g 1.17
	FRESHWATER DRUM	1982	0.23	-1.37×10^{-4}	0.03	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	CARP	1980 + 1981	0.16	2.04×10^{-5}	0.61	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	FRESHWATER DRUM	1978 - 1982	0.08	1.07×10^{-4}	0.11	SIGNIFICANT	200g 0.10	400g 0.13	600g 0.15	800g 0.17	1000g 0.19	1200g 0.21	— —	— —
	SAUGER	1978 - 1982	0.20	9.20×10^{-4}	0.28	SIGNIFICANT	100g 0.29	200g 0.38	300g 0.47	400g 0.57	500g 0.66	600g 0.75	— —	— —
	COMMON SUCKER	1978 - 1982	0.03	1.04×10^{-4}	0.12	SIGNIFICANT	— —	750g 0.10	1000g 0.13	1250g 0.16	1500g 0.19	— —	— —	— —
SELKIRK	WALLEYE	1980 - 1982	0.10	2.29×10^{-4}	0.54	SIGNIFICANT	— —	500g 0.21	750g 0.27	1000g 0.33	1250g 0.38	1500g 0.44	1750g 0.50	— —
	NORTHERN PIKE	1981	0.23	4.03×10^{-5}	0.04	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	WHITE BASS	1982	0.04	1.00×10^{-4}	0.04	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	CARP	1982	0.02	8.98×10^{-6}	0.23	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	GOLDEYE	1982	-0.15	1.11×10^{-3}	0.87	SIGNIFICANT	— —	200g 0.07	300g 0.18	400g 0.29	500g 0.40	— —	— —	— —
	WALLEYE	1981 - 1982	0.65	3.75×10^{-4}	0.22	SIGNIFICANT	250g 0.75	500g 0.84	750g 0.94	1000g 1.03	1500g 1.22	2000g 1.44	2500g 1.59	3000g 1.78
EAGLENEST LAKE	NORTHERN PIKE	1981 - 1982	0.50	3.62×10^{-4}	0.69	SIGNIFICANT	1000g 0.87	1500g 1.05	2000g 1.23	2500g 1.41	3000g 1.59	4000g 1.95	5000g 2.32	6000g 2.68
	COMMON SUCKER	1981 - 1982	-0.02	2.64×10^{-4}	0.27	SIGNIFICANT	— —	750g 0.18	1000g 0.24	1250g 0.31	1500g 0.37	— —	— —	— —
	GOLDEYE	1978 - 1982	-0.11	1.03×10^{-3}	0.32	SIGNIFICANT	— —	300g 0.20	400g 0.30	500g 0.40	600g 0.51	— —	— —	— —

TABLE 4: REGRESSIONS OF WEIGHT VS. MERCURY CONCENTRATIONS AND REGRESSION ESTIMATED MERCURY CONCENTRATIONS FOR SPECIFIC WEIGHTS OF FISH BIOMONITORED SINCE 1978, CONTINUED.

SITE	SPECIES	DATA FROM	REGRESSION WHERE µgHg/g = b(wt)+a a	b	r^2	ASSOCIATION SIGNIFICANCE WHERE H_o:B= 0 at t= = 0.05	ESTIMATED µg/g AT WEIGHT:							
POINTE DU BOIS	NORTHERN PIKE	1978 - 1982	0.45	1.25×10^{-4}	0.43	SIGNIFICANT	500g 0.51	1000g 0.57	2000g 0.70	3000g 0.82	4000g 0.95	5000g 1.07	6000g 1.20	7000g 1.34
	COMMON SUCKER	1978 - 1982	0.02	2.89×10^{-4}	0.22	SIGNIFICANT	250g 0.09	500g 0.16	750g 0.24	1000g 0.30	1250g 0.38	1500g 0.45	1750g 0.52	— —
	WALLEYE	1980 - 1982	0.09	4.55×10^{-4}	0.81	SIGNIFICANT	500g 0.32	1000g 0.54	1500g 0.77	2000g 1.00	2500g 1.23	— —	— —	— —
	MOONEYE	1978 - 1982	0.06	3.02×10^{-4}	0.22	SIGNIFICANT	— —	200g 0.12	300g 0.15	400g 0.18	500g 0.21	600g 0.24	700g 0.27	— —
	WHITEFISH	1978 - 1982	0.03	7.87×10^{-5}	0.28	SIGNIFICANT	— —	250g 0.05	500g 0.07	750g 0.09	1000g 0.11	1250g 0.13	1500g 0.14	— —
	SAUGER	1982	0.56	1.01×10^{-3}	0.32	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	WALLEYE	1980 - 1982	0.43	2.73×10^{-4}	0.33	SIGNIFICANT	— —	500g 0.57	1000g 0.70	1500g 0.84	2000g 0.98	2500g 1.13	3000g 1.25	— —
LAC DU BONNET	NORTHERN PIKE	1980 - 1982	0.13	2.53×10^{-4}	0.53	SIGNIFICANT	— —	750g 0.32	1000g 0.38	1250g 0.45	1500g 0.51	2000g 0.64	2500g 0.77	— —
	YELLOW PERCH	1981 - 1982	0.11	5.43×10^{-4}	0.19	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —
	COMMON SUCKER	1981	-0.31	4.03×10^{-4}	0.79	SIGNIFICANT	— —	— —	750g 0	1000g 0.10	1250g 0.20	1500g 0.30	— —	— —
	SHORTHEAD REDHORSE SUCKER	1980 + 1982	-0.19	5.59×10^{-4}	0.52	SIGNIFICANT	— —	500g 0.09	750g 0.23	1000g 0.37	— —	— —	— —	— —
	BURBOT	1982	-0.31	6.44×10^{-4}	0.81	SIGNIFICANT	— —	— —	750g 0.17	1000g 0.33	1250g 0.49	— —	— —	— —
	WALLEYE	1979 - 1982	0.34	4.18×10^{-4}	0.55	SIGNIFICANT	— —	500g 0.55	750g 0.66	1000g 0.76	1250g 0.87	1500g 0.97	2000g 1.18	— —
SOURIS	COMMON SUCKER	1979 - 1982	0.09	4.71×10^{-4}	0.13	SIGNIFICANT	— —	— —	750g 0.44	1000g 0.56	1250g 0.67	— —	— —	— —
	BROWN BULLHEAD	1979 - 1982	0.35	5.01×10^{-4}	0.06	NOT SIGNIFICANT	— —	— —	— —	— —	— —	— —	— —	— —

APPENDIX 1a: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE ASSINIBOINE RIVER AT BRANDON, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
	38.5	560	F	7	0.53
	36.2	670	M	3	0.17
	38.4	880	M	5	0.39
COMMON	42.8	1110	F	4	0.39
SUCKER	41.0	1080	F	4	0.29
	35.5	760	M	4	0.35
	32.0	500	M	3	0.14
	41.8	1020	F	4	0.26
	41.5	1050	F	5	0.32
	33.5	480	I-[illegible]	3	0.11
	29.6	360	F	10	0.53
	29.1	360	F	9	0.44
	27.8	330	M	6	0.16
	31.6	470	F	8	0.48
MOONEYE	29.4	390	F	5	0.26
	30.1	410	F	8	0.41
	30.4	490	F	8	0.28
	30.5	360	F	8	0.52
	29.2	410	F	7	0.32
	28.8	360	F	8	0.35
	56.4	2520	M	14	1.45
	33.0	360	F-I[illegible]	5	0.72
	47.4	1310	F	6	0.55
	36.2	530	I[illegible]	2	0.30
WALLEYE	40.1	740	M	5	0.54
	37.0	620	F	4	0.39
	44.7	1190	M	5	0.54
	40.2	800	F	6	0.82
	43.3	900	F	6	0.61
	48.2	1450	F	7	0.71
CHANNEL CATFISH	54.2	2430	M	6	0.24

APPENDIX 1b: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE ASSINIBOINE RIVER AT PORTAGE LA PRIARIE, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
	40.2	780	F	16	1.81
	31.5	340	F	6	0.84
SAUGER	32.0	350	M	6	0.86
	31.0	340	M	5	0.65
	27.6	170	F-Imm	3	0.33
	78.0	3510	F	8	1.36
	65.6	2080	F	6	0.40
	62.8	1900	M	4	0.37
	62.6	1940	M	5	0.45
	64.5	2780	F	7	0.25
	66.6	2540	M	6	0.47
	54.5	1300	M	4	0.24
	39.7	460	F-Imm	-	0.13
	43.0	540	F-Imm	2	0.08
NORTHERN	40.2	480	F-Imm	3	0.18
PIKE	64.7	2230	F	5	0.52
	55.0	1440	M	5	0.21
	66.3	2400	F	5	0.54
	63.5	2200	F	5	0.47
	58.0	1660	M	5	0.20
	36.5	370	M	2	0.16
	56.3	1350	F	4	0.32
	52.5	1110	M	5	0.46
	58.6	1480	F	4	0.33
	70.7	2810	F	6	0.52
	34.8	650	M	4	0.38
	40.1	1040	F	7	0.41
SHORTHEAD	41.5	1160	F	8	0.97
REDHORSE	44.7	1460	F	12	0.82
SUCKER	39.9	1150	M	6	1.01
	39.2	920	M	5	0.63
	38.2	1020	M	8	0.89
	37.2	780	F	5	0.35
	33.5	560	M	3	0.28
	29.3	370	M-Imm	3	0.17
	36.6	630	M	4	0.49
	51.2	1470	F	6	0.75
	29.3	280	M	3	0.17
	27.4	280	F-Imm	3	0.24
Walleye	48.1	1460	M	7	0.56
	50.8	1620	F	5	0.41
	31.7	400	M	2	0.22
	29.6	270	F-Imm	1	0.28
	26.7	200	F-Imm	2	0.36
	29.2	300	F-Imm	2	0.29
CHANNEL	53.7	1850	F	15	0.30
CATFISH	43.6	930	F	6	0.22

APPENDIX 1c: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE RED RIVER AT EMERSON RIVER, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
SAUGER	29.6	280	F	2	0.27
	31.8	340	M	7	0.73
	33.7	380	M	6	0.70
	24.8	140	M	3	0.54
	28.1	240	M	3	0.46
	35.5	500	F	7	0.70
	38.8	600	F	6	0.81
	33.2	380	F	5	0.46
	22.2	80	F-Imm	3	0.41
	20.7	60	F-Imm	2	0.22
	18.0	40	F-Imm	2	0.23
	39.1	710	F	6	0.30
	35.1	460	F	5	0.49
	35.7	480	F	4	0.38
	33.8	380	F	6	0.58
GOLDEYE	32.7	540	F	7	0.54
	25.8	200	M	5	0.16
	30.8	370	F	6	0.18
	31.3	400	M	6	0.65
	31.5	360	F	5	0.27
	28.3	290	M	5	0.30
	31.0	400	F	5	0.22
	31.4	360	F	6	0.29
	30.0	350	M	5	0.20
	27.4	240	M	5	0.11
WALLEYE	40.9	680	F	3	0.32
	35.9	480	M	3	0.42
	34.2	360	F-Imm	3	0.54
	45.2	900	F	4	0.56
	40.0	640	F-Imm	3	0.58
	54.0	2120	M	11	0.44
FRESHWATER DRUM	30.5	280	F	12	0.15
	41.2	710	M	26	0.55
	54.4	1560	F	48	0.52
	36.3	670	M	11	0.22
	36.0	600	M	11	0.27
	38.2	800	M	12	0.13
NORTHERN PIKE	75.0	3600	M	6	0.23
CHANNEL CATFISH	75.7	5600	F	15	0.97
	54.4	2230	F	12	0.26
	78.0	6870	F	14	0.77
	60 5	3000	Imm	12	0.18
	48.0	1500	Imm	11	0.23

APPENDIX 1d: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE RED RIVER AT ST. NORBERT, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	HG (µg/g)
SAUGER	27.3	200	M	3	0.43
	19.5	60	F-Imm	2	0.50
	31.2	380	F-Imm	6	0.89
	22.4	100	F-Imm	2	0.27
	19.2	70	F-Imm	2	0.16
	29.2	200	F	6	0.95
	35.8	480	M	7	0.74
	33.2	390	F	5	0.69
	36.4	520	F	5	0.76
	35.2	460	F	5	0.53
	28.5	240	F-Imm	3	0.57
	34.8	460	F	4	0.28
	35.1	500	F	5	0.55
	34.6	450	F	7	0.83
	33.9	450	F	5	0.51
	25.5	150	F	6	0.54
COMMON SUCKER	38.6	900	F	2	0.10
	34.2	800	M	3	0.22
	37.0	850	M	4	0.07
	38.2	740	M	3	0.16
	39.0	1040	M	4	0.27
	38.4	840	M	3	0.17
	37.8	740	M	2	0.20
	38.1	900	M	3	0.07
	37.8	780	F	4	0.07
	38.2	880	M	3	0.06
GOLDEYE	32.2	400	F	6	0.14
	30.0	300	M	5	0.37
	29.9	340	M	5	0.25
	37.0	580	F	7	0.64
	29.4	350	F	5	0.64
	27.6	220	M	4	0.09
	27.8	240	F	5	0.17
	29.3	250	F	5	0.18
	28.6	370	F	6	0.18
	30.5	400	F	6	0.43
	32.5	430	F	5	0.13
	32.0	360	F	6	0.85
	30.9	360	F	4	0.38
	28.8	260	M	6	0.64
	28.5	250	M	5	0.34
	28.5	240	M	4	0.32
	31.2	400	M	5	0.52
	27.5	240	M	4	0.21
	28.0	200	F	4	0.26
	26.7	220	F	4	0.14
CARP	70.0	6140	F	13	0.31
CHANNEL CATFISH	60.0	3140	F	13	0.21
	44.5	1100	Imm	6	0.19
	68.0	4960	F	14	0.81
WALLEYE	48.0	1200	F	4	0.35
	33.9	440	F	3	0.25
	34.0	400	F-Imm	2	0.32
	38.3	590	F-Imm	3	0.25
	22.5	100	Imm	1	0.26
	37.8	590	M	4	0.32
	33.8	410	M	2	0.15
	45.3	1000	F	4	0.40
	52.4	1600	F	7	0.64

APPENDIX 1e: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE RED RIVER AT SELKIRK, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
FRESHWATER DRUM	37.2	760	F	11	0.09
	41.0	990	M	10	0.20
	34.8	480	F	11	0.10
	38.5	770	M	12	0.25
	31.2	400	M	5	0.09
	32.7	460	M	13	0.08
	41.0	940	M	12	0.21
	36.7	680	F	11	0.10
	38.5	770	M	12	0.20
	39.2	870	M	12	0.16
SAUGER	25.6	160	M	3	0.34
	37.4	670	F	5	0.50
	36.5	360	M	8	0.78
	38.5	640	F	7	0.68
	36.2	500	F	6	0.72
	36.7	560	F	7	0.60
	33.3	390	F	6	0.54
	30.5	320	M	5	0.46
	30.8	350	M	6	0.41
	30.2	300	M	9	0.93
	29.6	280	M	6	0.49
	29.9	300	M	3	0.31
	31.0	300	M	7	1.08
	24.2	150	M	3	0.17
	29.5	260	M	6	0.73
	23.7	130	M-Imm	2	0.23
	23.0	120	M-Imm	3	0.18
	21.5	90	M	2	0.14
	20.1	80	M-Imm	1	0.12
	18.4	50	M-Imm	1	0.11
COMMON SUCKER	39.5	1000	M	4	0.09
	39.9	880	F	2	0.11
	42.0	1200	F	3	0.09
	40.6	1040	M	3	0.06
	39.4	950	F	2	0.07
	40.3	1130	M	3	0.08
	40.4	1000	F	3	0.12
	42.4	1230	F	3	0.18
	45.7	1340	M	7	0.22
	45.3	1510	M	8	0.24

APPENDIX 1e: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE RED RIVER AT SELKIRK, 1981, CONTINUED.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
	37.8	660	F-Imm	3	0.25
	39.2	640	M	3	0.27
	39.2	680	F	3	0.30
	46.4	1200	F	4	0.27
	37.6	580	M	3	0.28
	47.0	1140	M	5	0.42
	39.8	740	F	3	0.24
	38.2	570	F	3	0.21
	41.3	850	M	3	0.22
WALLEYE	33.5	410	M	2	0.25
	32.4	410	M	2	0.19
	39.2	660	M	3	0.30
	39.0	700	M	3	0.22
	36.8	650	M	3	0.23
	45.6	1150	F	4	0.26
	33.8	450	F	2	0.15
	33.2	450	M	2	0.22
	33.4	340	F	3	0.23
	37.6	550	F	2	0.17
	43.4	900	F	2	0.29
	63.3	2060	F	6	0.42
	56.9	1410	M	5	0.24
	53.1	1060	M	5	0.28
NORTHERN	58.0	1530	M	6	0.39
PIKE	54.1	1120	M	4	0.20
	53.8	1200	M	5	0.16
	50.7	870	M	4	0.33
	61.5	1950	M	4	0.21
	50.8	1020	M	5	0.33
	48.0	800	M	4	0.29

APPENDIX 1f: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE WINNIPEG RIVER AT EAGLENEST LAKE, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
	37.2	660	M	8	1.00
	45.0	1100	M	20	2.22
	37.7	660	M	9	1.27
	51.8	1720	F	14	1.14
	45.2	1150	M	12	1.50
	53.5	1920	F	11	0.90
	45.2	1220	M	15	1.35
	28.0	250	M-Imm	2	0.35
	38.0	700	F	7	0.85
WALLEYE	31.6	350	F-Imm	4	0.34
	42.9	890	F	8	1.26
	44.8	570	M	7	0.85
	45.5	1200	M	15	2.75
	37.9	660	F	8	1.21
	27.5	220	F-Imm	2	0.34
	36.2	580	M	5	0.65
	31.0	320	M-Imm	3	0.38
	39.3	740	F	6	0.47
	45.2	1140	M	18	1.33
	43.4	980	M	11	1.06
	60.1	1420	F	5	0.70
	50.2	860	M	4	1.45
NORTHERN	60.0	1520	M	6	1.32
PIKE	33.5	280	M	3	0.27
	51.5	1000	M	4	1.10
	53.2	1320	M	5	1.57
	46.7	790	F	4	0.40
	42.7	600	M	4	0.44
	42.6	1380	F	6	0.30
	46.4	920	M	6	0.23
	39.8	1080	M	6	0.28
COMMON	33.0	640	M	4	0.16
SUCKER	38.7	1040	M	6	0.16
	33.2	650	M	5	0.09
	39.0	900	M	7	0.31
	42.3	1280	F	4	0.16
	35.9	720	M	4	0.12
	41.1	1180	F	7	0.27

APPENDIX 1g: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE WINNIPEG RIVER AT POINTE DU BOIS, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
	35.4	600	F	10	0.82
	32.0	450	F	8	0.32
	34.5	630	F	7	0.46
	32.9	460	M	8	0.46
MOONEYE	34.5	580	F	11	0.45
	33.3	520	F	7	0.15
	30.8	420	F	8	0.22
	32.0	510	F	11	0.33
	29.2	360	F-Imm	7	0.19
	31.7	500	F	10	0.38
	36.0	340	M	3	0.20
	41.0	520	M	-	0.43
	36.0	340	M	2	0.20
NORTHERN	69.4	2620	F	8	0.63
PIKE	56.0	1520	M	7	0.91
	43.3	600	F	4	0.39
	49.6	800	F	4	0.62
	43.6	540	M	4	0.48
	42.5	500	F	4	0.48
	78.7	4550	F	10	1.20
	37.2	340	F-Imm	3	0.18
	41.3	1100	F	9	0.08
	38.7	940	F	4	0.07
	50.8	1810	F	9	0.45
COMMON	40.5	1140	M	4	0.18
SUCKER	44.4	1300	F	5	0.33
	44.4	1450	F	6	0.30
	38.3	1040	M	6	0.27
	40.1	1070	M	5	0.22
	39.2	930	M	9	0.59
	41.2	1140	M	9	0.68
	41.9	940	F	5	0.37
	49.8	1500	F	6	0.44
	39.2	800	M	5	0.41
	38.3	620	M	5	0.38
	44.3	1070	F	8	0.72
	38.0	650	?	5	0.42
	39.2	800	F	5	0.35
	36.9	570	F	4	0.32
	38.5	710	F	5	0.38
WALLEYE	39.0	710	F	5	0.43
	37.0	620	M	5	0.26
	32.6	410	M	4	0.33
	32.5	420	F	5	0.53
	31.5	360	F-Imm	3	0.26
	37.7	630	M	4	0.29
	37.0	620	M	5	0.33
	40.8	850	F	5	0.33
	31.5	380	F	3	0.22
	32.8	340	F	4	0.27
	37.2	340	F-Imm	3	0.18

APPENDIX 1h: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE WINNIPEG RIVER AT LAC DU BONNET, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
	30.3	420	F	7	0.19
	30.2	440	F	6	0.32
	31.8	480	F	-	0.31
	29.6	420	F	6	0.16
MOONEYE	29.3	400	F	-	0.15
	31.3	480	F-Imm	8	0.24
	31.7	500	F	7	0.21
	34.6	660	F	9	0.41
	30.0	370	F	9	0.16
	30.1	390	F-Imm	6	0.18
	43.7	1170	F	11	0.23
	38.0	950	M	6	0.08
	45.5	1340	M	7	0.16
	37.4	770	F	5	0.09
WHITEFISH	43.5	1330	F	7	0.16
	34.8	620	F	4	0.08
	43.6	1100	M	7	0.15
	34.7	660	M-Imm	4	0.06
	36.5	670	M	4	0.11
	37.0	740	M	4	0.08
	29.5	270	F	11	1.35
	21.0	80	F-Imm	3	0.35
	30.0	250	F	9	1.39
	31.4	360	M	10	1.26
SAUGER	30.7	340	F	9	0.87
	31.3	350	M	10	0.65
	32.3	340	F	10	1.06
	31.1	340	F	8	0.75
	31.0	350	M	7	0.85
	32.9	340	F	9	0.78
	26.2	200	F	5	0.51
	34.2	550	F	5	0.56
	35.2	540	M	5	0.47
	38.5	740	M	5	0.58
	40.5	760	F	5	0.39
	41.8	800	F	6	0.65
	34.9	520	F-Imm	6	0.60
	43.4	030	M	9	0.91
	42.6	860	M	8	0.82
	37.5	550	F	5	0.37
WALLEYE	46.8	1130	F	6	0.58
	54.9	1750	F	10	0.96
	40.2	730	F	5	0.46
	40.8	880	M	9	1.01
	40.2	700	F	6	0.49
	44.6	1070	F	5	1.31
	33.6	400	F-Imm	4	0.47
	60.8	2800	F	9	0.75
	40.7	720	M	5	0.74
	43.3	1060	M	9	0.73
	46.8	1160	F	7	0.49

APPENDIX 1h: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE WINNIPEG RIVER AT LAC DU BONNET, 1981,CONTINUED.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
	30.3	490	F	7	0.33
	27.5	400	F	5	0.34
	23.1	220	F	5	0.28
YELLOW	28.9	500	F	9	0.41
PERCH	25.0	250	F	7	0.30
	27.2	380	F	8	0.57
	26.0	300	F	5	0.20
	25.2	290	F	5	0.31
	24.0	250	F	2	0.17
	23.8	280	M	5	0.23
	48.0	700	F	4	0.41
	62.5	1940	F	4	0.43
NORTHERN	60.4	1680	M	5	0.69
PIKE	50.2	980	M	4	0.34
	44.9	650	M	4	0.41
	50.5	820	F	4	0.24
	57.9	1610	F	5	0.50
	42.6	1120	M	8	0.21
	48.6	1700	F	9	0.44
COMMON	39.3	980	F	3	0.05
SUCKER	40.5	1040	F	4	0.13
	39.9	1110	F	4	0.08
	37.4	880	M	3	0.09
	44.7	1470	F	6	0.20

APPENDIX 11: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE SOURIS RIVER AT SOURIS, 1981.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS)	Hg (µg/g)
WALLEYE	38.2	680	M	3	0.58
	37.5	660	M	3	0.91
	42.0	920	F	3	0.99
	44.6	1160	M	6	1.26
	37.2	670	M	3	0.67
	44.5	1140	F	3	0.92
	44.7	450	Imm	2	0.41
	36.2	570	Imm	4	0.71
	36.8	520	M-Imm	2	0.49
	36.0	600	F-Imm	3	0.44
	40.5	770	F-Imm	3	0.48
	39.4	710	F	3	0.56
	37.8	720	M	3	0.72
	39.8	730	M	3	0.66
	40.3	750	F-Imm	3	0.49
	39.4	740	F-Imm	3	0.55
	57.5	2400	F	6	1.09
	39.2	750	M	3	0.70
	35.0	590	F-Imm	3	0.40
	46.9	1230	F	7	0.75
COMMON SUCKER	41.2	1000	F	6	0.41
	37.0	690	F	3	0.27
	40.2	920	F	6	0.35
	38.5	930	M	6	0.52
	40.0	950	M	5	0.37
	36.5	710	M	7	0.67
	41.0	1050	F	4	0.67
	42.0	990	M	7	0.61
	37.7	830	M	5	0.60
	43.0	1070	F	4	0.60
BROWN BULLHEAD	24.8	280	M	4	0.31
	24.5	250	F	5	0.52
	23.2	230	M	4	0.31
	25.4	280	M	-	0.56
	24.8	250	F	5	0.51
	24.0	220	M	4	0.33
	27.5	300	M	5	0.74
	26.5	340	F	6	0.35
	25.2	310	M	6	0.53
	23.8	270	M	6	0.52
NORTHERN PIKE	35.0	270	F-Imm	3	0.38
	35.2	280	F-Imm	3	0.34
	48.1	740	M	4	0.38

APPENDIX 2a: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE ASSINIBOINE RIVER AT LAKE OF THE PRAIRIES, 1982.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (µg/g)
WALLEYE	49.4	1480	M	8	0.85
	31.0	380	M	3	0.33
	34.6	540	M	3	0.50
	29.7	300	F-Imm	3	0.29
	35.5	600	M	3	0.35
	59.3	2460	F	10	0.90
	35.4	580	M	3	0.45
	35.0	620	M	3	0.50
	43.6	1100	M	6	0.76
	52.2	1910	F	8	1.20
	50.0	1600	F	7	0.72
	41.7	870	M	6	0.61
	46.8	1200	M	8	0.81
	33.7	500	F	3	0.53
	44.9	1040	M	5	1.06
	44.0	1120	F	8	0.99
	36.7	600	M	3	0.58
	33.8	560	F-Imm	3	0.32
	35.4	620	M	3	0.38
	27.0	240	M-Imm	3	0.22
COMMON SUCKER	44.9	1420	F	6	0.19
	40.3	1160	M	6	0.21
	44.9	1360	M	7	0.23
	43.5	1440	F	4	0.13
	41.4	1300	F	7	0.20
	42.6	1380	M	6	0.20
	45.0	1580	F	5	0.20
	39.4	1040	M	7	0.22
	42.2	1340	M	4	0.14
	42.3	1360	M	8	0.20
SHORTHEAD REDHORSE SUCKER	42.2	1300	M	5	0.13
	44.4	1840	F	7	0.13
	46.5	1840	F	9	0.12
	37.5	900	M	3	0.05
	44.6	1720	F	7	0.11
	40.0	1280	M	6	0.08
	32.8	600	Imm	2	0.03
	35.0	800	Imm	3	0.06
	41.6	1300	M	6	0.12
NORTHERN PIKE	59.0	1310	F	4	0.28
YELLOW PERCH	20.4	180	F	3	0.07

APPENDIX 2b: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE ASSINIBOINE RIVER AT BRANDON, 1982.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (µg/g)
COMMON SUCKER	33.8	620	M	7	0.12
	32.5	560	M	6	0.12
	36.6	700	M	4	0.10
	28.6	400	Imm	2	0.04
	37.9	660	F	3	0.29
	30.6	400	I-mm	2	0.05
	38.5	720	M	3	0.32
	36.2	680	M	3	0.30
	37.8	720	F	3	0.27
	33.9	500	M	3	0.28
MOONEYE	29.9	360	M	6	0.35
	24.4	220	M	3	0.08
	23.0	200	M	3	0.24
	28.7	360	F	3	0.30
	28.8	400	F	5	0.11
	26.5	300	F	4	0.15
	25.2	280	F	4	0.20
	28.2	340	F	5	0.11
	26.0	280	F	4	0.07
	24.2	220	M	3	0.23
WALLEYE	33.5	460	M	3	0.39
	36.0	640	M	4	0.16
	30.8	360	M	3	0.21
	33.2	400	F	3	0.74
	56.1	2320	F	9	1.60
	51.0	1580	M	11	0.75
	35.4	540	F	2	1.10
	53.8	2060	F	8	0.80
	39.0	760	F	8	0.29
	39.0	660	M	3	0.28
	27.8	220	F	5	0.19
NORTHERN PIKE	60.5	1560	F	3	0.83
	55.0	1200	M	3	0.21
	56.9	1460	F	4	0.22
CHANNEL CATFISH	35.4	620	Imm	3	0.08
	45.5	1280	F-Imm	6	0.26
	42.5	960	F	4	0.18
	53.5	2310	F	5	0.29
	31.0	400	Imm	3	0.05
	29.5	340	Imm	3	0.04
SHORTHEAD REDHORSE SUCKER	32.0	580	F	4	0.15
	33.6	600	F	3	0.08
	37.0	800	F	4	0.22
	33.5	640	M	3	0.17
	38.5	820	F	5	0.34
	31.0	500	M	2	0.10
	30.5	460	M	2	0.09
	38.5	820	F	8	0.54
	29.6	340	Imm	3	0.20
	29.2	360	Imm	3	0.12
ROCK BASS	18.2	180	M	2	0.12
	20.0	260	M	2	0.19
	19.0	200	F	2	0.32

APPENDIX 2c: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE ASSINIBOINE RIVER AT PORTAGE LA PRAIRIE, 1982.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (µg/g)
SAUGER	31.4	340	F	3	0.30
	27.2	250	F	3	0.29
	27.5	200	F	3	0.31
	28.1	240	M	3	0.23
	26.3	200	M	3	0.31
	29.2	260	F	3	0.30
	24.9	160	M	3	0.24
	23.3	120	F	3	0.27
	26.4	180	M	3	0.28
	20.4	70	M	3	0.38
NORTHERN PIKE	58.0	1480	M	3	0.86
	65.7	2450	F	3	0.72
	65.7	2300	F	3	0.93
	47.5	1020	M	1	0.25
	75.0	4980	F	4	0.71
	72.2	3800	F	4	0.91
	61.0	2020	M	3	0.62
	66.5	2220	M	3	1.30
	65.8	2580	F	3	0.61
	65.3	2520	M	4	0.67
	74.0	3440	F	5	1.24
	76.7	3800	F	5	0.98
	67.5	2700	M	4	0.73
	64.0	2100	M	4	1.17
	65.0	2620	M	4	0.83
SHORTHEAD REDHORSE SUCKER	40.3	1220	F	6	0.34
	42.7	1520	F	9	0.36
	45.0	1580	F	9	0.37
	41.8	1250	M	8	0.23
	42.2	1440	F	7	0.25
	35.8	960	F	3	0.34
	33.0	580	M	4	0.25
	33.0	700	F	3	0.30
	34.2	700	M	3	0.25
	29.5	400	Imm	3	0.21
WALLEYE	58.2	3160	F	10	1.55
	40.2	800	F	6	1.05
	44.0	1120	F	5	0.70

APPENDIX 24: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE RED RIVER AT EMERSON, 1982.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (ug/g)
SAUGER	22.5	80	F	2	0.23
	28.1	200	M	3	0.62
	20.0	40	F	3	0.36
	33.8	400	F	3	0.35
	22.2	80	F	3	0.39
	34.4	400	F	6	0.71
	24.5	160	M	4	0.61
	31.4	340	F	4	0.27
	31.0	340	M	5	0.64
	31.2	340	F	3	0.21
	33.0	400	F	6	0.24
	36.8	520	F	4	0.65
	30.9	300	F	6	0.46
	35.6	450	F	4	0.71
	32.7	360	M	4	0.26
	29.5	280	F	3	0.16
	25.3	160	F-Imm	6	0.12
	29.6	250	F	3	0.06
	23.4	120	M-Imm	-	0.28
	26.5	180	F	3	0.27
GOLDEYE	25.6	180	M	3	0.07
	26.3	220	M	3	0.47
	29.0	260	F	3	0.29
	28.9	280	Imm	3	0.50
	30.7	320	F	4	0.49
	27.0	200	Imm	4	0.05
	27.0	220	M	3	0.08
	29.4	280	M	3	0.21
	30.1	320	M	3	0.33
	33.0	460	F	4	0.41
WALLEYE	40.5	680	F	3	0.76
	43.9	920	F	3	0.57
	41.2	720	M	2	0.57
	44.2	980	M	8	0.69
	35.8	460	M	9	0.32
	44.3	840	F	3	0.76
	32.8	360	F	-	0.27
	40.7	650	F	3	--
FRESHWATER DRUM	38.4	940	F	13	0.15
	25.5	150	F	12	0.14
	28.0	240	Imm	2	0.06
	26.7	180	Imm	13	0.08
	28.2	220	F	13	0.12
	32.0	300	F	13	0.40
	29.7	260	F	13	0.10
NORTHERN PIKE	45.6	600	M	3	0.18
	58.5	1380	F	3	0.56
	62.9	1980	M	3	0.57
	58.7	1460	M	2	1.12
	55.0	1160	M	3	0.58
CARP	38.5	1080	F	4	0.40
	37.6	900	M	4	0.23
	26.7	380	Imm	3	0.03
	40.0	1280	F	6	0.21
	36.0	800	M	5	0.43
	32.9	620	M	5	0.18
	41.7	1300	F	5	0.39
	35.0	700	F	2	0.07
	37.0	850	F	3	0.14

APPENDIX 2e: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE RED RIVER AT ST. NORBERT, 1982.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (µg/g)
SAUGER	15.7	20	Imm	2	--
	28.2	240	M	6	0.52
	23.7	120	F	4	0.35
	36.0	540	F	4	0.41
	39.8	740	F	7	0.70
	31.7	420	M	3	0.29
	29.8	300	F	3	0.22
	34.1	440	M	8	0.61
	32.6	410	F	4	0.22
	30.4	320	F	3	0.19
	30.6	300	F	3	0.40
	29.7	300	F	3	0.30
	30.6	340	F	4	0.24
	32.0	380	F	4	0.17
	37.5	640	F	7	0.32
	32.4	380	F	3	0.21
	32.1	400	F	4	0.28
	32.9	380	F	4	0.30
	28.2	250	M	3	0.19
WALLEYE-SAUGER HYBRID	38.3	660	F	6	0.80
COMMON SUCKER	36.7	700	F	2	0.20
	36.5	700	F	5	0.19
	35.8	640	M	1	0.24
	36.5	700	M	1	0.41
	40.0	980	M	2	0.12
	34.6	600	M	3	0.29
	35.7	660	F	3	0.19
	38.4	720	F	2	0.26
	39.5	960	F	2	0.16
	34.6	710	M	1	0.13
GOLDEYE	31.0	340	M	5	0.49
	31.0	340	F	3	0.41
	26.4	220	F	3	0.15
	30.5	320	F	5	0.30
	29.4	240	F	3	0.41
	27.6	260	M	3	0.24
	26.8	220	M	3	0.07
	27.7	240	M	3	0.07
	26.8	200	M	3	0.07
	26.5	220	F	3	0.09
NORTHERN PIKE	63.8	1920	F	3	0.72
	45.0	620	M	2	0.86
	48.2	830	M	3	1.00
	56.7	1460	F	3	0.58
WALLEYE	54.5	1940	F	7	1.26
	17.7	40	Imm	-	0.42
	63.0	3000	M	12	1.31
	44.0	770	M	4	0.73
	41.5	740	F	8	0.70
CHANNEL CATFISH	72.7	5220	M	13	1.41
	43.5	1020	M	6	0.32
	44.0	1010	M	6	0.08
	44.0	1100	M	6	0.09
FRESHWATER DRUM	30.6	300	F	14	0.19
	31.5	400	M	7	0.14
	25.9	150	F-Imm	13	0.14
	32.2	360	F-Imm	13	0.31
	25.8	240	Imm	2	0.05
	25.7	170	Imm	12	0.23
	23.3	80	Imm	12	0.31

APPENDIX 25: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF RESIDENTIONED FISH FROM THE RED RIVER AT HALSTAD, 1988.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (mg/g)
FRESHWATER DRUM	39.3	960	M	13	0.23
	39.9	1180	F	12	0.30
	37.5	770	M	11	0.29
	36.9	860	M	13	0.19
	36.7	780	F	14	0.13
	34.8	660	F	12	0.21
	37.8	780	M	12	0.25
	33.2	510	F-Ova	5	0.05
	36.2	700	M	12	0.26
RAINBOW	28.1	220	F	3	0.40
	27.0	200	F	3	0.30
	36.2	580	F	6	0.71
	27.5	240	F	3	0.19
	24.5	140	F-Ova	3	0.24
	28.2	220	M	3	0.29
	30.3	280	M-Ova	4	0.21
	27.4	280	M	4	0.25
	26.5	160	M	3	0.22
	25.6	160	M	3	0.29
	25.2	160	F	3	0.16
	23.5	140	M	3	0.24
	25.5	160	M	3	0.36
	22.5	100	M	2	0.10
	24.4	160	M	3	0.12
	28.2	240	F	3	0.19
	25.8	200	M	3	0.17
	25.6	200	M	-	0.24
	23.2	100	M	3	0.22
	24.2	120	M	-	0.18
COMMON SUCKER	33.5	750	F	2	0.13
	37.0	900	F	3	0.08
	39.3	1020	M	3	0.12
	40.3	1140	M	3	0.11
	47.4	1800	F	6	0.38
	38.3	980	M	4	0.19
	40.2	1040	M	4	0.24
	39.0	1020	M	2	0.08
	37.2	1000	M	3	0.29
	37.0	940	F	3	0.13
WALLEYE	40.5	820	M	3	0.22
	35.2	580	M	3	0.13
	40.0	840	M	3	0.17
	44.8	1060	M	8	0.28
	36.0	680	M	3	0.21
	37.4	720	M	3	0.28
	39.8	700	M	14	0.28
	49.4	1540	M	6	0.36
WHITE BASS	27.0	380	F	2	0.07
	26.3	380	M	2	0.06
	25.3	320	M	3	0.10
	27.0	420	F	-	0.11
	25.7	320	M	2	0.08
	25.5	340	F	2	0.06
CARP	46.0	1980	F	4	0.04
	26.0	500	I-ma	2	0.02
	26.0	420	I-ma	1	0.03
	23.0	360	I-ma	1	0.02
	24.0	380	I-ma	1	<0.02
	25.7	380	I-ma	1	<0.02
	33.8	380	I-ma	1	<0.02
	34.5	380	I-ma	1	<0.02
	25.0	340	I-ma	1	0.04
	27.0	480	I-ma	1	0.04
GOLDEYE	32.0	500	F	5	0.44
	29.2	320	M	3	0.15
	25.1	180	M	3	0.12
	25.5	260	M	3	0.09
	26.2	240	M	3	0.13
	25.1	250	M	3	0.11
	25.0	240	M	3	0.10

APPENDIX 2g: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE WINNIPEG RIVER AT EAGLENEST LAKE, 1982.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (µg/g)
WALLEYE	41.6	980	M	15	1.30
	55.0	2220	M	16	1.80
	37.1	580	F-Imm	6	0.71
	57.1	2160	F	12	1.20
	43.2	1040	F	11	1.00
	34.3	500	M	6	0.50
	58.3	3060	F	16	1.90
	37.4	700	M	8	0.88
	53.2	2300	F	12	1.50
	47.8	1350	M	11	0.94
	46.1	1360	M	11	1.28
	41.8	960	F-Imm	7	0.97
	33.4	460	M	5	0.64
	38.6	660	M-Imm	7	0.65
	32.1	400	Imm	5	0.49
	55.2	2380	F	10	0.90
	29.2	260	F-Imm	4	0.45
	45.0	1280	M	12	0.71
	46.7	1400	M	3	1.19
	41.6	1000	M	8	0.92
NORTHERN PIKE	60.7	1420	F	3	1.40
	52.0	1000	M	4	0.64
	52.5	1180	M	3	0.85
	38.8	440	M	2	0.36
	43.6	560	F	3	0.53
	49.2	960	M	4	1.10
	42.7	520	F-Imm	3	0.64
	90.0	6280	F	6	2.60
COMMON SUCKER	44.8	1640	F	6	0.25
	41.2	1300	F	6	0.31
	43.2	1350	F	6	0.30
	38.7	1020	M	4	0.19
	42.5	1400	M	6	0.43
	42.1	1260	M	7	0.53
	37.6	1020	F	4	0.17
	33.5	780	M	4	0.15
	40.2	1200	M	6	0.63
	45.0	1720	F	5	—
SMALLMOUTH BASS	30.2	610	F	5	0.71
BURBOT	51.7	1120	F	6	0.51
CISCO	28.0	420	F	4	0.28
	26.7	360	M	4	0.18

APPENDIX 2b: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE WINNIPEG RIVER AT POINTE DU BOIS, 1982.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (µg/g)
WHITEFISH	30.8	440	F	7	0.60
	31.2	500	F	8	0.27
	31.7	560	F	10	0.30
	31.3	460	F	8	0.19
	27.8	340	M	6	0.19
	28.6	400	F	8	0.17
	27.2	340	F	7	0.13
	28.1	360	F	7	0.13
	25.4	320	M	6	0.13
	32.3	500	F	12	0.45
NORTHERN PIKE	65.7	2280	F	5	1.00
	66.0	2780	F	4	0.68
	47.5	800	M	3	0.55
	65.4	2640	F	4	1.10
	72.4	3750	M	6	1.40
	87.5	5460	F	6	0.98
	78.2	5960	F	4	0.95
	91.8	7340	F	9	1.30
	91.6	6760	F	8	1.70
COMMON SUCKER	46.4	1600	F	8	1.70
	42.3	1440	M	10	0.48
	40.3	1080	M	4	0.35
	45.2	1700	F	5	0.23
	41.1	1220	F	4	0.19
	43.2	1440	M	8	0.52
	47.0	1700	F	7	0.32
	40.2	1300	M	7	0.32
	44.1	1800	F	6	0.25
	42.2	1380	F	4	0.22
WALLEYE	60.0	2720	F	16	1.59
	48.8	1580	M	12	1.10
	58.7	2500	F	10	1.02
	46.0	1320	M	10	0.95
	40.6	820	F	6	0.47
	44.6	1060	M	6	0.41
	37.5	720	M	6	0.47
	39.0	940	F	6	0.43
	27.0	700	M	5	0.46
	54.0	2500	F	11	1.17
	35.5	600	F-Imm	6	0.53
	38.0	840	M	6	0.57
	36.7	600	F-Imm	5	0.44
	34.0	560	M	6	0.48
SMALLMOUTH BASS	38.5	1200	F	9	1.08
	32.5	760	F	6	0.68

APPENDIX 21: [illegible]

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (ug/g)
[illegible]	35.0	340	F	12	0.23
	28.2	440	F	6	0.10
	27.4	300	F	6	0.06
	27.2	250	F	5	0.12
	27.5	340	M	4	0.11
	28.7	480	[illegible]	9	0.14
	27.7	340	M	6	0.10
	33.6	650	F	16	0.37
	29.6	460	M	6	0.10
	30.3	500	F	7	0.18
[illegible]	29.4	320	M	6	0.04
	28.2	340	F	3	0.02
	32.8	440	[illegible]	2	0.02
	31.2	340	[illegible]	2	0.03
	37.3	1000	M	6	0.07
	30.2	340	[illegible]	2	0.04
	34.8	600	F	4	0.05
	31.2	340	[illegible]	2	0.02
	40.1	1300	M	5	0.05
	38.0	1140	F	4	0.03
[illegible]	33.5	540	F	10	0.04
	36.1	540	M	15	1.08
	33.0	440	M	12	1.39
	30.2	300	M	7	1.40
	28.7	300	F	8	0.54
	31.3	340	[illegible]	3	0.43
	34.4	340	[illegible]	2	0.48
	33.6	340	M	2	0.37
[illegible]	43.5	1300	F	6	0.34
	42.7	910	M	6	0.39
	46.2	1360	F	13	1.57
	44.7	1000	F	6	0.38
	32.4	600	M	3	0.49
	46.0	1360	M	12	1.13
	38.3	720	M	6	0.52
	40.2	720	M	6	0.70
	38.7	720	M	5	0.63
	39.5	340	[illegible]	3	0.38
	42.8	1360	F	8	0.59
	48.2	1360	F	6	1.12
	45.0	1250	F	6	0.76
[illegible] BASS	36.6	740	F	6	0.73
[illegible] PIKE	38.7	1720	M	5	0.69
	48.3	3650	F	5	1.32
	45.8	740	F	2	0.31
	36.0	720	F	6	0.88
YELLOW PERCH	27.3	400	F	6	0.20
	26.5	280	F	6	0.14
[illegible]	42.6	780	M	6	0.06
	46.8	1360	M	7	0.07
	36.0	1360	M	8	0.26
	46.3	1360	M	3	0.04
	36.3	1360	M	8	0.16
	34.1	1360	M	8	0.08
	33.0	1360	M	8	0.09
	33.0	1360	F	8	0.15
	42.2	720	F	6	0.06
	46.0	80	F	6	0.04
[illegible] [illegible] PERCH	36.0	1360	F	6	0.14
	33.0	1360	[illegible]	5	0.08
	36.2	1360	F	5	0.27
	36.6	1360	M	5	0.16
	33.5	1360	M	6	0.08
	36.0	1360	F	5	0.08
	31.7	1360	M	6	0.08
	36.1	1360	M	5	0.08
	40.5	1360	F	8	0.05
	36.0	680	F	6	0.07

APPENDIX 2j: GENERAL PHYSICAL DATA AND MUSCLE TISSUE MERCURY CONCENTRATIONS OF BIOMONITORED FISH FROM THE SOURIS RIVER AT SOURIS, 1982.

SPECIES	LENGTH (cm)	WEIGHT (g)	SEX	AGE (YRS.)	Hg (µg/g)
WALLEYE	41.1	920	F	4	0.82
	41.7	1100	F	3	0.88
COMMON SUCKER	41.0	1060	F	3	0.69
	34.8	640	M	6	0.61
	39.2	840	F	4	0.65
	39.0	860	M	3	0.78
	37.0	740	F	2	0.21
	40.3	1060	F	3	0.38
	36.0	680	F	2	0.18
	42.2	1120	F	2	0.85
	39.8	980	M	3	0.45
	37.0	800	F	3	0.18
BROWN BULLHEAD	28.1	500	M	5	0.43
	20.1	120	Imm	2	0.58
	22.2	200	F	3	0.41
	26.0	340	F	3	0.46
	24.5	220	F	3	0.31
	26.6	320	F	3	0.68
	27.1	290	F	2	0.29
	23.8	200	M	3	0.36
	22.4	220	M	3	0.38
	23.5	200	F	2	0.28
NORTHERN PIKE	40.6	500	M	1	0.41
	41.5	480	M	2	0.51
	49.2	820	M	2	0.42
	39.8	400	F	2	0.67
YELLOW PERCH	25.3	280	F	3	0.43
	23.0	240	M	4	0.40
	23.7	240	F	3	0.33

APPENDIX 3: REGRESSIONS OF WEIGHT VS. MERCURY CONCENTRATIONS AND REGRESSION ESTIMATED MERCURY CONCENTRATIONS FOR SPECIFIC WEIGHTS OF 1981 - 1982 BIOMONITORED FISH.

LAKE OF THE WOODS	PRAIRIES	SPECIES	YEAR	REGRESSION: mg/g = b(wt) + a a	b	r^2	ESTIMATED mg/g AT 500g	750g	1000g	1250g
		Walleye	1982	0.26	3.01×10^{-4}	0.65	500g 0.65	750g 0.55	1000g 0.65	1250g 0.75
		Common Sucker	1982	0.29	-7.57×10^{-5}	0.12	750g 0.34	1000g 0.22	1250g 0.20	1500g 0.18
		Shorthead Redhorse Sucker	1982	0.003	6.88×10^{-5}	0.73	500g 0.04	1000g 0.07	1500g 0.11	2000g 0.14
		Common Sucker	1981	0.15	1.74×10^{-4}	0.11	750g 0.29	1000g 0.33	1250g 0.37	1500g 0.42
B			1982	-0.16	5.78×10^{-4}	0.41	0.28	0.42	0.57	0.71
B		Sauger	1981	0.36	4.95×10^{-5}	<0.01	500g 0.37	750g 0.37	1000g 0.38	1250g 0.38
			1982	0.15	1.79×10^{-4}	0.02	0.17	0.18	0.20	0.22
A		Walleye	1981	0.25	3.99×10^{-4}	0.62	500g 0.45	750g 0.55	1000g 0.65	1250g 0.75
B			1982	0.19	4.38×10^{-4}	0.49	0.41	0.52	0.63	0.74
D		Northern Pike	1982	-1.53	1.38×10^{-3}	0.52	500g 0	1000g 0	1500g 0.55	2000g 1.34
G		Channel Catfish	1982	0.02	1.36×10^{-4}	0.85	1000g 0.13	2000g 0.29	3000g 0.42	4000g 0.54
E		Shorthead Redhorse Sucker	1982	-0.11	5.26×10^{-4}	0.45	500g 0.15	750g 0.28	1000g 0.42	1250g 0.53
		Rock Bass	1982	0.17	1.73×10^{-4}	0.10	150g 0.20	200g 0.21	250g 0.22	300g 0.22
		Sauger	1981	-0.05	2.40×10^{-3}	0.98	200g 0.43	300g 0.67	400g 0.91	500g 1.15
F			1982	0.32	-1.58×10^{-4}	0.08	0.29	0.28	0.26	0.24
G		Northern Pike	1981	-0.02	2.34×10^{-4}	0.57	500g 0.09	1000g 1.21	1500g 0.33	2000g 0.45
E			1982	0.65	7.09×10^{-5}	0.07	0.68	0.72	0.75	0.79
T		Shorthead Redhorse Sucker	1981	-0.13	7.93×10^{-4}	0.69	500g 0.27	750g 0.46	1000g 0.66	1250g 0.86
A			1982	0.20	8.22×10^{-5}	0.35	0.25	0.27	0.29	0.31
G		Walleye	1981	0.21	2.37×10^{-4}	0.59	500g 0.33	750 0.39	1000g 0.45	1250g 0.51
E			1982	0.68	2.05×10^{-4}	0.73	0.76	0.83	0.90	0.97
		Channel Catfish	1981	0.14	8.70×10^{-5}	1.00	1000g 0.23	2000g 0.31	3000g 0.40	4000g 0.49

APPENDIX 3: [illegible] OF WEIGHT VS. ENERGY CONSUMPTION AND RESULTING ESTIMATED ENERGY CONSUMPTION FOR ARBITRARY WEIGHTS OF JUVE. - ADULT FRESHWATER FISH, CONTINUED.

SIZE	SPECIES	YEAR	ENERGY mg/g = b(wt) + a			ESTIMATED mg/g AT			
			a	b	r^2				
S	Sauger	1981	0.35	3.98×10^{-4}	0.18	200g 0.43	300g 0.47	400g 0.51	500g 0.55
		1982	0.34	5.21×10^{-4}	0.12	0.34	0.40	0.45	0.50
M	Goldeye	1981	-0.14	1.23×10^{-3}	0.45	200g 0.11	300g 0.25	400g 0.35	500g 0.45
		1982	-0.05	1.25×10^{-3}	0.32	0.20	0.32	0.45	0.57
L	Walleye	1981	0.50	-2.14×10^{-5}	0.02	500g 0.48	750g 0.48	1000g 0.47	1250g 0.47
		1982	0.88	6.84×10^{-4}	0.03	0.42	0.59	0.76	0.93
S	Freshwater Drum	1981	0.20	2.65×10^{-4}	0.28	25g 0.17	50g 0.24	75g 0.30	100g 0.37
		1982	0.14	4.35×10^{-3}	0.01	0.15	0.16	0.17	0.18
O	Northern Pike	1982	0.13	3.55×10^{-4}	0.20	500g 0.31	1000g 0.49	1500g 0.67	2000g 0.85
U	Channel Catfish	1981	-0.05	1.39×10^{-4}	0.78	1000g 0.09	2000g 0.36	3000g 0.64	4000g 0.92
	Carp	1982	-0.08	3.02×10^{-4}	0.20	1000g 0.27	1500g 0.42	2000g 0.57	2500g 0.72
	Sauger	1981	0.39	5.74×10^{-4}	0.18	200g 0.51	300g 0.56	400g 0.62	500g 0.68
S		1982	0.16	4.43×10^{-4}	0.18	0.25	0.29	0.34	0.38
	Common Sucker	1981	0.04	1.16×10^{-4}	0.02	75g 0.13	100g 0.16	125g 0.19	150g 0.22
S O		1982	0.40	-3.70×10^{-4}	0.29	0.21	0.12	0.02	0
T. S	Goldeye	1981	0.06	0.92×10^{-4}	0.16	100g 0.15	200g 0.24	300g 0.33	400g 0.42
		1982	-0.42	2.69×10^{-3}	0.66	0	0.08	0.33	0.58
S	Walleye	1981	0.15	2.47×10^{-4}	0.71	500g 0.38	750g 0.54	1000g 0.69	1250g 0.85
		1982	0.47	3.16×10^{-4}	0.92	0.63	0.71	0.79	0.87
S	Northern Pike	1982	1.02	-2.07×10^{-4}	0.01	500g 0.92	1000g 0.81	1500g 0.71	2000g 0.60
T	Channel Catfish	1981	-0.08	1.45×10^{-4}	0.02	1000g 0.11	2000g 0.26	3000g 0.40	4000g 0.55
		1982	-0.15	2.98×10^{-4}	0.97	0.15	0.45	0.75	1.04
	Freshwater Drum	1982	0.25	-1.37×10^{-4}	0.80	200g 0.22	250g 0.20	300g 0.19	350g 0.17

APPENDIX 3: REGRESSIONS OF WEIGHT VS. MERCURY CONCENTRATIONS AND REGRESSION ESTIMATED MERCURY CONCENTRATIONS FOR SPECIFIC WEIGHTS OF 1981 - 1982 SUNNYBROOK FISH, CONTINUED.

SITE	SPECIES	YEAR	REGRESSION: mg/g = ln(wt) ÷ a			ESTIMATED mg/g AT			
			a	b	r^2				
	Freshwater Drum	1981	-0.01	2.23×10^{-4}	0.33	250g 0.04	500g 0.10	750g 0.16	1000g 0.21
E		1982	0.18	7.60×10^{-6}	<0.01	0.18	0.19	0.19	0.19
E	Sauger	1981	0.21	8.97×10^{-4}	0.34	100g 0.30	200g 0.39	300g 0.48	400g 0.57
		1982	0.03	1.06×10^{-3}	0.70	0.14	0.24	0.35	0.46
L	Common Sucker	1981	-0.18	2.69×10^{-4}	0.66	750g 0.02	1000g 0.09	1250g 0.16	1500g 0.23
		1982	-0.08	2.50×10^{-4}	0.42	0.11	0.17	0.24	0.30
E	Walleye	1981	0.16	1.34×10^{-4}	0.34	500g 0.22	750g 0.26	1000g 0.29	1250g 0.32
		1982	0.10	1.66×10^{-4}	0.54	0.18	0.22	0.26	0.31
I	Northern Pike	1981	0.23	4.03×10^{-5}	0.04	500g 0.25	1000g 0.27	1500g 0.29	2000g 0.31
E	White Bass	1982	0.04	1.00×10^{-4}	0.04	200g 0.06	300g 0.07	400g 0.08	500g 0.09
E	Carp	1982	0.02	8.98×10^{-6}	0.23	500g 0.03	1000g 0.03	1500g 0.04	2000g 0.04
	Goldeye	1982	-0.15	1.11×10^{-3}	0.87	100g 0	200g 0.07	300g 0.18	400g 0.29
E	Walleye	1981	0.44	7.29×10^{-4}	0.29	500g 0.80	1000g 1.17	1500g 1.53	2000g 1.90
A		1982	0.65	2.99×10^{-4}	0.33	0.80	0.95	1.10	1.25
G L									
L A	Northern Pike	1981	0.14	7.90×10^{-4}	0.43	1000g 0.93	2000g 1.72	3000g 2.51	4000g 3.30
H E		1982	0.47	3.50×10^{-4}	0.89	0.82	1.17	1.52	1.87
N E									
E	Common Sucker	1981	0.03	1.78×10^{-4}	0.34	750g 0.17	1000g 0.21	1250g 0.26	1500g 0.30
S		1982	0.04	2.37×10^{-4}	0.13	0.27	0.28	0.34	0.40
T									
	Ciscoe	1982	-0.42	1.67×10^{-3}	1.00	200g 0	300g 0.08	400g 0.25	500g 0.41
P	Shoepoe	1981	-0.36	1.48×10^{-3}	0.42	300g 0.08	400g 0.25	500g 0.37	600g 0.52
O		1982	-0.19	1.05×10^{-3}	0.30	0.13	0.23	0.34	0.44
I S	Northern Pike	1981	0.31	1.95×10^{-4}	0.74	1000g 0.51	1500g 0.61	2000g 0.70	2500g 0.80
H O		1982	0.64	1.04×10^{-4}	0.44	0.76	0.79	0.84	0.90
T I	Common Sucker	1981	0.13	1.54×10^{-4}	0.04	500g 0.21	750g 0.25	1000g 0.29	1250g 0.33
E S		1982	-0.03	3.30×10^{-4}	0.03	0.14	0.22	0.30	0.39
	Walleye	1981	0.21	2.30×10^{-4}	0.31	500g 0.32	1000g 0.44	1500g 0.55	2000g 0.67
D		1982	0.18	4.38×10^{-4}	0.83	0.40	0.61	0.83	1.05
U	Smallmouth Buffalo	1982	-0.01	9.00×10^{-4}	1.00	500g 0.44	750g 0.67	1000g 0.90	1250g 1.13

APPENDIX 3: REGRESSIONS OF WEIGHT VS. MERCURY CONCENTRATIONS AND REGRESSION ESTIMATED MERCURY CONCENTRATIONS FOR SPECIFIC WEIGHTS OF 1981 - 1982 SASKATCHEWAN FISH CHECKED.

SIZE	SPECIES	YEAR	WEIGHT ug/g = b(wt) + a			ESTIMATED ug/g AT			
			a	b	r^2				
	Sheepe	1981	-0.16	8.70×10^{-4}	0.70	300g 0.10	400g 0.18	500g 0.27	600g 0.36
		1982	-0.08	5.19×10^{-4}	0.58	0.08	0.13	0.18	0.23
L	Whitefish	1981	-0.02	1.50×10^{-4}	0.62	250g 0.02	500g 0.05	750g 0.09	1000g 0.13
		1982	0.02	2.56×10^{-5}	0.38	0.02	0.03	0.04	0.04
A	Sauger	1981	0.42	1.61×10^{-3}	0.17	700g 0.74	800g 0.90	900g 1.07	1000g 1.23
		1982	0.56	1.01×10^{-3}	0.32	0.77	0.87	0.97	1.07
C	Walleye	1981	0.51	1.71×10^{-4}	0.14	500g 0.59	1000g 0.68	1500g 0.76	2000g 0.85
		1982	0.13	6.35×10^{-4}	0.64	0.44	0.76	1.08	1.40
D	Northern Pike	1981	0.34	1.58×10^{-4}	0.36	1000g 0.60	1500g 0.68	2000g 0.56	2500g 0.64
		1982	-0.01	4.13×10^{-4}	0.76	0.40	0.61	0.82	1.02
	Shorthead Redhorse Sucker	1982	-0.31	6.44×10^{-4}	0.81	500g 0.01	750g 0.17	1000g 0.33	1250g 0.49
T	Yellow Perch	1981	0.10	6.31×10^{-4}	0.31	250g 0.23	300g 0.29	400g 0.35	500g 0.40
		1982	-0.10	7.50×10^{-4}	1.00	0.05	0.13	0.20	0.28
	Common Sucker	1981	-0.31	4.03×10^{-4}	0.79	750g 0	1000g 0.10	1250g 0.20	1500g 0.30
	Burbot	1982	-0.31	6.44×10^{-4}	0.81	750g 0.17	1000g 0.33	1250g 0.49	1500g 0.65
	Walleye	1981	0.36	3.73×10^{-4}	0.44	500g 0.56	750g 0.66	1000g 0.75	1250g 0.84
H		1982	0.51	3.33×10^{-4}	1.00	0.68	0.76	0.85	0.93
O	Common Sucker	1981	0.20	3.25×10^{-4}	0.09	750g 0.47	1000g 0.56	1250g 0.65	1500g 0.73
		1982	-0.13	7.12×10^{-4}	0.23	0.41	0.58	0.76	0.94
	Brown Bullhead	1981	0.18	1.05×10^{-3}	0.08	100g 0.29	150g 0.34	200g 0.39	250g 0.44
		1982	0.41	7.27×10^{-5}	<0.01	0.42	0.42	0.42	0.43
I	Northern Pike	1981	0.35	4.16×10^{-5}	0.25	1000g 0.39	1500g 0.41	2000g 0.43	2500g 0.45
		1982	0.73	-4.21×10^{-4}	0.42	0.31	0.10	0	0
	Yellow Perch	1982	-0.02	1.02×10^{-3}	0.53	200g 0.30	250g 0.36	300g 0.46	350g 0.54

POOR

QUALITY

ORIGINAL